





REPORT
ON THE
TREES AND SHRUBS
GROWING NATURALLY IN
THE FORESTS OF MASSACHUSETTS.

PUBLISHED AGREEABLY TO AN ORDER OF
THE LEGISLATURE,
BY THE COMMISSIONERS ON THE ZOOLOGICAL AND BOTANICAL
SURVEY OF THE STATE.

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TO HIS EXCELLENCY GOV. BRIGGS :

Dear Sir,—

THE accompanying Report concludes the work of the Commissioners on the Zoological and Botanical Survey of the State. It has been prepared with especial reference to the instructions of Gov. Everett, accompanying his commission, and directing the Commissioners "to keep carefully in view the economical relations of every subject of their inquiry." I trust it may do something "to promote the agricultural benefit of the Commonwealth," by leading citizens who are land owners to a consideration of the importance of continuing, improving, and enlarging the forests of the State.

It is due to the Legislature, and to yourself, that I should make some apology for the tardy appearance of my Report. It is well known to your Excellency, that ever since the commission was issued, in 1837, I have been occupied, for ten months of every year, in a pursuit which left me no leisure for the Survey, and little for reading, on subjects connected with it. I have, therefore, been able to give to it only the summer vacation, and of that a considerable portion has, every year, been necessarily taken up with other things. Under these circumstances, it was hardly possible for me to give to the Survey the attention it deserved, and let my Report appear at an earlier period.

I am, respectfully,

Your Excellency's friend and servant,

GEO. B. EMERSON.

September 19, 1846.



P R E F A C E .



IN order that this Report should answer the ends for which the Survey was ordered, the descriptions of the Trees and Shrubs are arranged according to the Natural System. This has been done, not from undervaluing the artificial system of Linnæus, which must still continue of use in aiding to find the name of a plant and its place in the Natural System, but from a conviction of the incomparably greater value of the latter. The artificial system is based essentially on distinctions drawn from the stamens and pistils alone. The Natural System, on the contrary, takes into consideration not one part only, but every part and whatever relates to it,—the seed, from the development of its embryo to its germination, the growth, formation and arrangement of the wood, bark, buds and leaves, and the flower and fruit. It is found that plants which resemble each other in the external forms of their more essential parts, have a similar resemblance in properties and uses, and require similar modes of management and culture. The adoption of the Natural System is, therefore, particularly important in a comparatively new country like ours. Upon the culture, properties and uses of many of our trees and shrubs, few or no experiments have been made. We must learn what modes of culture are likely to answer best with them, by observing what modes have been successful with well-known plants of the same families and affinities, in the old countries. Of many of them, the value in building, and the various mechanic arts, in dyeing and tanning, and as furnishing articles of food, or materials for medicine, are not yet known. We shall be likely to find them most readily by looking for uses similar to what are known to belong to plants most analogous to them. "If there is," says De Candolle, "a country where the theory of analogy between forms and properties may become eminently useful, it is North America, which, situated in the same latitude as Europe, is occupied by analogous vegetation."

The uses of the natural arrangement in abridging the labor of acquisition and aiding the memory of the learner are most important, and its advantages to cultivators, to physicians,—to all who are seeking to enlarge their knowledge of the useful or dangerous properties of plants, that they may be able to avail themselves of the one, or counteract the other, to gain materials for the arts, or remedies or antidotes in medicine, are too many to enumerate and too obvious to be further insisted upon.

In the Conspectus, or Distribution into Families and Genera, I have attempted to offer a substitute, so far as the plants treated of in this Report are concerned, for the arrangement by the artificial system. This attempt I submit with many misgivings. If it shall be considered a failure, it may at least serve to aid others in more successfully accomplishing the object.

My sketches of the natural families, and, in a considerable degree, of the genera, are necessarily drawn mostly from books; and, as they are taken from the standard works of the science, Endlicher, Lindley, Torrey, and others, are usually given without particular acknowledgment of the source. Botanists will here, however, find some points touched upon which have not usually received much attention from scientific writers.

The descriptions of the species of all the trees, and nearly all the shrubs, are my own, except where I have expressly given credit to others. To collect my materials, I have scoured the forests in almost every part of the State, from the western hills of Berkshire to Martha's Vineyard, and from the banks of the Merrimack to the shores of Buzzard's and Narragansett Bays. The leisure of several summers was first spent in ascertaining what the ligneous plants of Massachusetts are, and how they are distributed. If I have not discovered new species, I have found new localities for several oaks, willows, poplars, pines, and birches, and some others of less importance, and have thus enlarged the Flora of the State. That some species have escaped me is altogether probable, as, even in the summer of 1845, I found the Red Birch growing abundantly on a branch of the Merrimack, some hundreds of miles further north than it had previously been noticed by any botanist.

After having become familiar with the trees and their local-

ties, I began to collect materials for their description; and every important tree and shrub has been described from copious notes taken under or near the growing plant itself. A point with which I have each year been more and more struck, is the beauty of our native trees and of the climbing vines and undergrowth associated with them. I have thrown aside much which I had written upon this point. Utilitarian readers will perhaps find too much still retained. My apology for not pruning more severely must be found in my sincere conviction, that associations with the beauty of trees about our country homes enter deeply into the best elements of our character; and a hope that what I have written may induce some of my readers to plant trees, for the purpose of increasing the beauty and the appearance of seclusion and quiet of the homes of their wives and children.

In the progress of the work, I found it necessary to curtail very considerably what I had prepared, especially in regard to the families and genera, as it was evident, if I should go on to describe all the families with the same minuteness of detail even as is given to the pines and oaks, I should write several volumes instead of one.

It was my original intention to add to the volume, in the form of an appendix, a strictly scientific synopsis of the families, genera and species, with synonymes and references in the usual form. But as the volume is already large, I have concluded to suppress this, although, by so doing, I subject myself to the charge of omitting or neglecting several things of importance. All omissions and defects will, however, I trust, at no distant period, be much more than supplied. The Genera of New England plants, by Prof. Gray, now, I understand, in a forward state of preparation, and the Flora of New England, by that most thorough botanist, Wm. Oakes, for which all the friends of Natural Science have long been anxiously looking, will, when they appear, place the botany of New England where it should be; and show the difference between the work of men who are able to give the labor of years to the favorite pursuit of their lives, and the hasty sketch of one whose heart, he is obliged to confess, is, most of the year, wholly in other things,

and who gives to a work great enough to command a life, the scanty hours of recreation of his summer holidays.

A Report upon the Botany of the State is certainly very incomplete, without even an enumeration of the Algæ, the Mosses, the Lichens, and the Fungi; and, with a hope to prevent this omission, I furnished myself, at the commencement of this Survey, with several somewhat expensive works upon these departments of botany. But I am obliged to confess, that I have been able to do very little in regard to them. Since the commencement of this Survey, my friend, Rev. J. L. Russell, of Hingham, has carefully prepared a catalogue of the mosses in the eastern part of the State, which he was kind enough to place at my disposal. I was not willing that its publication should be delayed till the appearance of this volume, and it has been published in the Boston Journal of Natural History. Mr. Edward Tuckerman also prepared, at my request, a catalogue of the lichens found on the bark of trees in this State. As it is to be hoped that he will soon give us a complete account of the lichens of New England, for which work he is amply prepared, it would be doing him injustice to publish an imperfect catalogue. The deficiency in the history of the Algæ is likely to be soon supplied, by Prof. Bailey, of West Point, in the thorough manner of which he has given evidence in the Scientific Journal.

In writing my descriptions, I have, as far as possible, avoided the use of technical language. To avoid it entirely is impossible. When a part, an organ, a form, or a modification of form is spoken of which has no English name, it must either be called by its scientific name, or it must be described by a tedious circumlocution, repeated as often as the thing is spoken of, and, after all, scarcely more intelligible even to the unlearned reader than the scientific word, which expresses precisely the thing meant and nothing else.

In the preparation of the Report, I have availed myself of whatever I found most to my purpose, but never, intentionally, without giving credit, except in the cases mentioned above. The numerous facts obtained from Loudon and Michaux, are usually given in their words. Some of the best

things are quoted from the incomparable descriptions of Bigelow. I am under obligations to Dr. Gray for suggestions in regard to the distribution into families and genera; but I should be sorry, to have him considered responsible for any thing in its execution. Mr. Oakes has furnished me with many beautiful specimens, such as nobody else can make. To Mr. Russell, I am indebted for a communication upon the Pitch Pine, and for other favors, as well as for the catalogue of Mosses. To my friends, Messrs. E. Tuckerman and B. D. Greene, I owe thanks for the use of specimens from their extensive herbaria. Dr. Barratt, of Middletown, Conn., has given me important assistance in the study of the Poplars and Willows; and from the invaluable Report of my friend Dr. Harris, I have, with his consent, obtained much information, not to be found elsewhere, in regard to insects.

To so many citizens of the Commonwealth am I indebted for aid received in conducting the Survey and ascertaining the condition of the forests, that I can do no more than mention their names. From Hon. D. P. King and Messrs. S. P. Fowler, of Danvers; Josiah Newhall, of Lynnfield, and Lilley Eaton, of South Reading; J. L. Lewis, of Hingham, Samuel A. Turner, of South Scituate, and my friend G. P. Bradford, then of Plymouth; from Messrs. Chester Adams, of South Natick, and Daniel Adams, 3d, of Newbury; Daniel Davis, of Fairhaven, Thomas A. Greene, of New Bedford, and Hezekiah Barnard, of Nantucket; S. Davis, of Truro, Solomon Freeman, of Brewster, and E. Swift, of Falmouth; from Messrs. Jabez Newel, and Abijah M. Ide, of South Attleborough; Rhodolphus Sanderson, of East Whately, and D. Willard, of Greenfield; C. B. Rising, of Worthington, and Joseph Field, of Charlemont; C. S. Darling, of Gill, and Samuel Mixter, of New Braintree; Allen C. Metcalf, of Lenox, J. H. Cobb, of Dedham, and S. Salisbury, of Worcester; from Henry Colman, of the Agricultural Survey, and especially from Wm. Bacon, of Richmond, Austin Bacon, of Natick, and Henry W. Cushman, of Bernardston, I received very useful letters,—from the three latter gentlemen, communications of great value.

From Messrs. P. T. Jackson, N. Hale, Ch. L. Storrow, B. T.

Reed, W. Raymond Lee, of Boston, and A. E. Swasey, of Taunton, I received facilities in ascertaining the quantity of wood consumed on rail-roads; and from my friends, T. B. Curtis, of Boston, and H. Kingsbury, of Kennebunk, Me., letters containing valuable information in regard to the kinds and quantities of wood employed in ship-building.

To my friends, Dr. O. W. Holmes, whose poetical eye is also an eye for trees, and J. J. Dixwell, who knows how to represent them, I am indebted for numerous measurements of trees; and to my learned friend Dr. A. A. Gould, who, to his other attainments in natural science, unites a familiar knowledge of botany, I am particularly indebted for most important advice and assistance in very many instances.

In the ship-yards in Boston, New Bedford and other towns in the State, and the numerous saw-mills, machine-shops, and manufactories of furniture, of agricultural implements, and of all other articles of wood, and on the farms and wood-lots in all parts of the Commonwealth, whither I went, in almost all instances, a stranger, to make inquiries,—every where, with one solitary exception, I was very civilly received, and had my questions answered with the greatest kindness and intelligence; and every where I found a readiness to furnish me, or let me furnish myself, with specimens of the flowers, leaves, fruit and wood of the trees I was examining. To all persons from whom I have received these acts of kindness, I would here make my cordial acknowledgments. I shall always esteem it one of the best fruits of my labors in this Survey, that they have brought me better acquainted than I otherwise could have been, with the intelligence, hospitality, and good and kind manners of the common people in every part of the State. If there are better manners and a higher intelligence among the people in other countries, I should like to travel amongst them; but I very much doubt whether, in any country on which the sun shines, there are, amongst the people in common life, more of those qualities which are always pleasant to meet with, delightful to remember, and most honorable to our common humanity to record, than are found among the independent mechanics and yeomanry of Massachusetts.

TABLE OF CONTENTS.

THE Forests, page 1. Object of the Report, 2. Uses of the forests ;—form a soil, 3. Conduct electricity, 4. Soften the climate, protect from winds, 5. Give beauty to a country, 6. Variety of our forest trees, 9. Use for shade, 10. Furnish materials for the arts, 11. Shipbuilding, 12. The forests wasted, 13. Maple sugar, 14. Fuel, 14. Continuation and improvement of the forests, 16. Species of trees, 17. Names little known, 18. Trees for fuel, shipbuilding, 19. Fencing, furniture, implements, tanning, 20. Improvable lands, 21. Rocky hills ; marshes, 22. Thinning and pruning, 23. The principle of pruning ; mode, 24. Selecting, 25. Cutting smooth ; how soon renewed, 25. Age, 27. Season, 27. Succession of forests, 29. Things injurious to a forest : browsing, injudicious pruning, sea breeze, 31. Upon planting near the sea ; on exposed hills, 32. Strength and durability of timber, 33. Buffon's mode of felling, 34.

Woody Plants of Massachusetts ; distribution into families and genera ; description of a flower and fruit, 37. Figures, 38. Division into families, 39. Plants with opposite leaves, 40. Plants with alternate leaves, 41. Division into genera, 42.

FIRST GENERAL DIVISION. DICOTYLEDONOUS PLANTS, 45.

CHAPTER I. *Plants with naked seeds.*

FAMILY I. Pine Family, 47. Products of the pines, 48. Root ; trunk, 49. Branches ; wood, 50. Leaves, 51. Buds ; flower, 52. Fruit, 53. Insects on the pines, 54. Soil for pines, 56. Propagation and culture, 57. Transplanting ; division, 59. SECTION FIRST. PINE AND FIR Tribe. Genus 1. The Pine. Sp. 1. White pine, 60. Sp. 2. Pitch pine, 66. Planting with, 71. Sp. 3. Red or Norway pine, 74. Genus 2. Spruce. Sp. 1. Hemlock, 77. Sp. 2. Black or Double Spruce, 81. Sp. 3. Single or White Spruce, 84. Genus 3. Fir. Sp. 1. Balsam fir, 85. European fir. Sp. 2. Double balsam fir, 88. Genus 4. Larch. Sp. 1. Hacmatack, 89. Planting with larch, 91. Cedar of Lebanon, 95. SECTION SECOND. CYPRESS Tribe. Genus 5. Arbor Vitæ. Cedar. Sp. 1. American arbor vitæ, 96. Genus 6. Cedar or Cypress. Sp. 1. White cedar, 98. Fence of, 100. European cypress, Southern cypress, 101. Genus 7. Juniper. Sp. 1. Red cedar, 102. Cedar apple, 106. Sp. 2. Juniper, 108. SECTION THIRD. The Yews. Genus 8. Yew, 110. Sp. 1. Ground hemlock, 111.

CHAPTER II. *Amentaceous Plants.*

FAMILY II. Oak Family, 113. Genus 1. Oak, 115. Value, 116. Insects on, 117. Bark, 120. Root, 121. Flowers ; fruit, 122. Growth, 123. Species, 124. Arrangement, 125. Table of species, 126. Sp. 1. White oak, 127. Sp. 2.

- Overcup White, 132. Sp. 3. Post or Rough, 133. Sp. 4. Swamp White, 135. Sp. 5. Chestnut, 137. Sp. 6. Rock chestnut, 138. Sp. 7. Little Chincapin, 140. Sp. 8. Black or Yellow-barked, 141. Sp. 9. Scarlet, 144. Sp. 10. Red, 148. Sp. 11. Bear, 150. Grouping of the oaks, 151. Planting with oaks, 152. English oaks, 157. Genus 2. Beech. Sp. 1. American, 158. European, 162. Genus 3. Chestnut, 163. Sp. 1. American, 164. Genus 4. Hazel, 170. Sp. 1. American, 171. Sp. 2. Beaked, 173.
- FAMILY III. Hornbeam Family. Genus 1. Hornbeam. Sp. 1. American, 174. Genus 2. Hop Hornbeam. Sp. 1. American, 177.
- FAMILY IV. Walnut Family, 180. Insects, 180. Genus 1. Walnut, 181. Sp. 1. Butternut or oilnut, 182. Sp. 2. Black walnut, 185. Genus 2. Hickory, 187. Sp. 1. Shellbark, 191. Sp. 2. Mockernut, 194. Sp. 3. Pignut, 197. Sp. 4. Bitternut, 199.
- FAMILY V. Birch Family, 201. Genus 1. Birch, 202. Sp. 1. Black, or Sweet, 203. Sp. 2. Yellow, 206. Sp. 3. Red, 208. Sp. 4. Canoe, 210. Sp. 5. White, 213. European Birch, 215. Planting, 216. Genus 2. Alder, 217. Sp. 1. Common, 218. Sp. 2. Speckled, 220.
- FAMILY VI. Wax Myrtle Family. Genus 1. Myrtle. Sp. 1. Sweet Gale or Dutch Myrtle, 222. Sp. 2. Bay Berry or Wax Myrtle, 224. Genus 2. Liquidamber. Sp. 1. Sweet fern, 225.
- FAMILY VII. Plane Tree Family, 226. Genus 1. Plane Tree. Sp. 1. Buttonwood, or occidental Plane, 227. Malady in the buttonwoods, 232. Oriental Plane, 235. Californian, 237.
- FAMILY VIII. Willow Family, 239. Genus 1. Poplar, 240. Insects on, 242. Sp. 1. Large, 242. Sp. 2. American aspen, 243. Sp. 3. Balm of Gilead, 245. Sp. 4. River, 246. Sp. 5. Necklace, 249. True Balsam poplar, 251. Genus 2. Willow, 252. GROUP 1. Sallows. Sp. 1. Sage, 255. Var. 2, 256—var. 3, 257. Sp. 2. Muhlenberg's, 257. GROUP 2. Two-colored. Sp. 3. Bog, 258. Sp. 4. Woolly-headed Swamp. Sp. 5. Prinos-like, 259. Sp. 6. Dense-flowered Early, 260. Sp. 7. Frost or Tender, 261. GROUP 3. Sp. 8. Brittle Gray, 262. GROUP 4. Osiers. GROUP 5. Brittle, 263. Sp. 9. Crack, 264. Sp. 10. Varnished, 265. Sp. 11. Bedford, 266. Sp. 12. Glossy, 267. GROUP 6. White. Sp. 13. The White, 268. Blue. Sp. 14. Yellow Willow, or Golden Osier, 269. Sp. 15. Weeping, 270. Sp. 16. Black, 271. Sp. 17. Pursh's, 272. GROUP 7. Ochre-flowered. Sp. 18. Beaked, 274. GROUP 8. Cordate. Sp. 19. Heart-leaved, 275. Sp. 20. Stiff-leaved, 276. Sp. 21. Torrey's, 277.
- FAMILY IX. Bread-Fruit Family, 279. Genus 1. Mulberry Tree. Sp. 1. Red Mulberry, 280. Paper Mulberry; Osage orange, 282.

CHAPTER III. *Plants whose Flowers are without Petals, and not arranged in Aments.*

- FAMILY X. Elm Family, 284. Genus 1. Elm, 285. Insects on, 286. Sp. 1. American Elm, or White Elm, 286. Sp. 2. Slippery Elm, 297. English Elm, 299. Scotch Elm, 305. River Elm; Racemed Elm, 305. Genus 2. Nettle Tree. Sp. 1. American, 306. Sp. 2. Hackberry, 309. Planer tree; Tselkwa tree, 312.

- FAMILY XI. Sandal Wood Family, 312. Genus 1. Tupelo, 313. Sp. 1. Tupelo tree, Snag, Horn Pine, or Pepperidge, 313.
- FAMILY XII. Cinnamon Family, 317. Genus 1. Sp. 1. Sassafras, 319. Insects on, 321. Genus 2. Benzoin. Sp. 1. Fever Bush or Spice Bush, 324.
- FAMILY XIII. Mezereum Family. Genus 1. Dirca. Sp. 1. Leather wood, 325.
- FAMILY XIV. Crowberry Family. Genus 1. Oakesia. Sp. 1. Plymouth Crowberry, 327.

CHAPTER IV. *Monopetalous Plants.*

- FAMILY XV. Olive Family, 329. 1. OLIVE Tribe. Genus 1. Privet. Sp. 1. Common Prim, 330. 2. LILAC Tribe. 3. ASH Tribe. Genus 2. Ash, 332. Sp. 1. White, 333. Sp. 2. Red, 337. Sp. 3. Black, 338. European, 339.
- FAMILY XVI. Holly Family, 340. Genus 1. Holly. Sp. 1. American, 341. Genus 2. Wild Holly. Sp. 1. Mountain, 343. Genus 3. Winter Berry. Sp. 1. Black Alder, 344. Sp. 2. Single Berry Black Alder, 345. Sp. 3. Ink Berry, 346.
- FAMILY XVII. Madder Family, 347. Coffee, 348. Genus 1. Sp. 1. Button Bush, 349. Genus 2. Sp. 1. Partridge Berry, 351.
- FAMILY XVIII. Honeysuckle Family, 352. Genus 1. Linnæa. Sp. 1. Twin-flower, 353. Genus 2. Triosteum, 354. Sp. 1. Fever Root, 355. Genus 3. Lonicera. Sp. 1. Hairy Honeysuckle, 356. Sp. 2. Small-flowered Yellow Honeysuckle, Woodbine. Evergreen Honeysuckle, 357. Japan Honeysuckle. Sp. 3. Fly Honeysuckle, 358. Sp. 4. Hairy Fly Honeysuckle. Genus 4. Diervilla. Sp. 1. Three-flowered Bush Honeysuckle, 359.
- FAMILY XIX. Elder Family, 360. Genus 1. Elder. Sp. 1. Panicked, 361. Sp. 2. Common, 362. Genus 2. Guelder Rose. Viburnum. SECTION 1. Sp. 1. Naked Viburnum. Sp. 2. Sweet, 364. Sp. 3. Arrow Wood, 366. Sp. 4. Maple-leaved Arrow Wood, 367. SECTION 2. Sp. 1. Cranberry Tree, 368. Sp. 2. Wayfaring Tree, 369.
- FAMILY XX. Heath Family, 370. ANDROMEDA Tribe. Genus 1. Andromeda, 371. Sp. 1. Water Andromeda, 372. Genus 2. Cassandra. Sp. 1. Dwarf, 373. Genus 3. Lyonia, 374. Sp. 1. Panicked. Genus 4. Zenobia, 375. Sp. 1. Clustered, 376. Genus 5. Clethra. Sp. 1. Alder-leaved, 377. Genus 6. Epigæa. Sp. 1. May Flower, 378. Genus 7. Gaultheria, 379. Sp. 1. Chequer Berry, 380. Genus 8. Bear Berry. Sp. 1. Common, 381. RHODORA Tribe, 382. Genus 9. Rhododendron, 383. Sp. 1. American Rose Bay, 384. SECTION Azalea. Sp. 1. Swamp Pink, 387. Sp. 2. Upright Honeysuckle, 389. RHODORA. Sp. 1. Canada. Genus 10. Kalmia, 390. Sp. 1. Mountain Laurel, 392. Sp. 2. Narrow-leaved Kalmia. Sp. 3. Glaucous, 394. Genus 11. Ledum, 395. Sp. 1. Labrador Tea, 396.
- FAMILY XXI. Whortleberry Family, 397. Genus 1. Whortleberry, 398. Sp. 1. Black. Sp. 2. Dangleberry, 399. Sp. 3. Bush Whortleberry, 400. Sp. 4. Deerberry, 401. Sp. 5. High Bush Whortleberry, 401. Black Swamp. Sp. 6. Blue, 402. Sp. 7. Low Blueberry, 403. Sp. 8. Cowberry, 404. Genus 2. Cranberry. Sp. 1. Common, 405. Sp. 2. European. Genus 3. Chiogenes, 406. Sp. 1. Mountain Partridge Berry, 407. Trumpet Flower, 407.



CHAPTER V. *Plants with the Petals and Stamens growing from the Calyx, except in Cornus.*

- FAMILY XXII. Cornus Family. Genus 1. Cornel, 408. SECTION 1. Sp. 1. Alternate-leaved, 409. Sp. 2. Round-leaved. Sp. 3. Red-stemmed, 410. Sp. 4. Panicle. Sp. 5. Silky, 411. SECTION 2. Sp. 6. Flowering Dogwood, 413. SECTION 3. Sp. 7. Dwarf Cornel, 415.
- FAMILY XXIII. Witch Hazel Family. Genus 1. Witch Hazel. Sp. 1. Common, 416.
- FAMILY XXIV. Currant Family, 419. Genus 1. Ribes. Sp. 1. Prickly Gooseberry. Sp. 2. Common Wild, 420. Sp. 3. Round-leaved. Sp. 4. Swamp, 421. Sp. 5. Large flowering currant. Sp. 6. Mountain, 422.
- FAMILY XXV. Cactus Family, 423. Genus 1. Indian Fig. Sp. 1. Prickly Pear, 424.
- FAMILY XXVI. Rose Family, 425. SPIRÆA Tribe. Genus 1. Spiræa. Sp. 1. Nine Bark, 426. Sp. 2. Queen of the Meadows. Sp. 3. Steeple Bush, 427. BRAMBLE Tribe. Flowering Raspberry, 428. Red Raspberry; High Blackberry; Low Blackberry. Thimbleberry. Bristly Blackberry. ROSE Tribe, 429. Early Wild Rose; Swamp; Shining, 430.
- FAMILY XXVII. Apple Family. Genus 1. Thorn, 430. Sp. 1. Cockspur, 433. Sp. 2. Scarlet-fruited, 434. Sp. 3. Pear-leaved. Sp. 4. Dotted-fruited, 435. Genus 2. Pear, 436. Pear Tree, 437. Apple, 438. Sp. 1. American Mountain Ash, 439. Rowan Tree, 440. Sp. 2. Choke Berry, 441. Genus 3. Wild Sugar Pear, 442. Sp. 1. Shad Bush. Variety 1. June Berry, 443. Var. 2. Swamp Sugar Pear, 444. Quince, 446.
- FAMILY XXVIII. Almond Family, 446. Insects on, 447. Genus 1. Plum, 448. Sp. 1. Beech. Sp. 2. Yellow, 449. Wild Bullace Tree, 450. Genus 2. Cherry. SECTION 1. Sp. 1. Northern Red, 451. Sp. 2. Sand. SECTION 2. Sp. 3. Black, 453. Sp. 4. Choke, 456.
- FAMILY XXIX. Bean Family, 456. Genus 1. Locust, 458. Insects on, 459. Sp. 1. Common Locust, 460. Kentucky Coffee Tree. Canada Judas Tree, 465.

CHAPTER VI. *Plants with many Petals which grow, together with the Stamens, about or upon a Disk surrounding the Seed-vessel.*

- FAMILY XXX. The Vine Family. Genus 1. Grape Vine, 466. Sp. 1. Fox Grape, 467. Sp. 2. Summer, 469. Sp. 3. Wine. Sp. 4. River or Sweet-scented, 470. Genus 2. Ampelopsis. Sp. 1. Virginian Creeper, 471.
- FAMILY XXXI. Buckthorn Family, 472. Genus 1. Buckthorn. Sp. 1. Common, 473. Sp. 2. Alder-leaved, 474. Genus 2. Ceanothus. Sp. 1. New Jersey Tea, 475.
- FAMILY XXXII. Staff-Tree Family, 476. Genus 1. Bladder-nut. Sp. 1. Three-leaved, 477. Genus 2. Staff-Tree. Sp. 1. Waxwork, 478. Horse-Chestnut Tree, 479.
- FAMILY XXXIII. Maple Family, 480. Genus 1. Maple. Large-leaved; Round-leaved; Norway; Field; Montpelier; Guelder-rose-leaved; Italian; Tartarean; Smooth-leaved; Sycamore, 481. Insects, 482. Sp. 1. Red Maple, 483. Colors of the leaves not caused by frost, 484. Causes, 485. Sp. 2. White Maple, 487. Sp. 3. Rock or Sugar, 489. Varieties of the Wood, 491. Making of Sugar, 493. Sp. 4. Striped Maple, 496. Sp. 5. Mountain, 497.

CHAPTER VII. *Polypetalous Plants with Stamens and Petals growing upon the receptacle.*

- FAMILY XXXIV. Sumach Family, 499. Genus 1. Sumach. Tanner's; Varnish; Venetian; Smoke Tree, 500. Sp. 1. Stag's Horn, 501. Sp. 2. Smooth, 502. Sp. 3. Mountain or Dwarf, 503. Sp. 4. Poison, 504. Indian Poke a remedy for the poison, 505. Sp. 5. Poison Ivy, 506. Sp. 6. Fragrant Sumach, 507.
- FAMILY XXXV. Prickly Ash Family. Genus 1. Xanthoxylum, 508. Sp. 1. Prickly Ash, 509.
- FAMILY XXXVI. Linden Family. Genus 1. Linden or Lime Tree, 510. Sp. 1. Bass Wood, 511.
- FAMILY XXXVII. Rock Rose Family, 515. Genus 1. Sun Rose, 516. Sp. 1. Canada. Genus 2. Pinweed, 517. Sp. 1. Large. Sp. 2. Thyme-leaved. Sp. 3. Small. Genus 3. Hudsonia, 518. Sp. 1. Downy. Sp. 2. Heath-like, 519.
- FAMILY XXXVIII. Barberry Family. Genus 1. Barberry, 520. Sp. 1. Common, 521.
- FAMILY XXXIX. Moonseed Family, 524. Genus 1. Moonseed. Sp. 1. Canada.
- FAMILY XL. Magnolia Family, 525. Genus 1. Magnolia, 526. Cucumber Tree; Long-leaved Cucumber; Three-petalled; Heart-leaved; Yulan; Purple. Sp. 1. Small Magnolia, 527. Genus 2. Liriodendron. Sp. 1. Tulip Tree, 529.

SECOND GENERAL DIVISION.

CHAPTER VIII. *Monocotyledonous Plants.*

- FAMILY XLI. Smilax Family, 532. Genus 1. Smilax. Sp. 1. Green Briar, 533. Sp. 2. Carrion Flower, 534.
- Explanation of the Plates, 535. Index, 536. Plates.



TREES OF MASSACHUSETTS.



THE FORESTS.

THE immense variety, the many and important uses, and the great beauty of our forests, must, naturally, attract the attention of an observer; and, as the preservation and improvement of the forests, in their highest degree, are above private effort, require joint action, and must be effected on a large scale, on a system wisely begun and long continued, by the men of one generation for those of the next; and by the application of science, taste and skill, not by one but by many men, not in one village or town, but in a county and state; it is wise in a government not acting merely for the present, but extending its forethought generously onwards, making its knowledge and wisdom an invested capital for future use, and desiring to do for coming generations, what they, when looking back, shall wish it had done,—it is wise, prudent and patriotic for such a government to order a survey of the forests, among its other domains, that the people may know the sources of their wealth and its extent, and learn how to value, enlarge and enjoy it. The conception and ordering of this general survey, was worthy of the descendants of those who established free schools, free courts of justice, and freedom in religion. The idea was a noble one, with whatever success the work may have been executed.

The object of the present report, which comes tardily in to complete the survey so well accomplished by the other gentlemen engaged in it, is to describe the trees and shrubs of the forests of Massachusetts, to set forth their importance, their general and particular relations, uses and properties, and the modes by which they may be preserved, propagated, and improved. It is not written for the use of men of science. If any such read it, however, they may find in it many particulars relating to trees, which have not been hitherto recorded; as they may miss much which a more scientific inquiry would have brought to light. But it is for the common, unlearned citizens, who live on farms, in the country, and have few books and little leisure. It is, as far as possible, for it cannot be wholly, divested of technical language, in order that they may understand it. And it will accomplish the purpose for which it was written, if it awaken them to a deeper sense of the value of some of the blessings by which they are surrounded, and lead them, or any of them, to resolve to preserve the old forests and plant new.

A few generations ago, an almost unbroken forest covered the continent. The smoke from the Indian's wigwam rose only at distant intervals; and to one looking from Wachusett or Mount Washington, the small patches laid open for the cultivation of maize, interrupted not perceptibly the dark green of the woods. Now, those old woods are every where falling. The axe has made, and is making, wanton and terrible havoc. The cunning foresight of the Yankee seems to desert him when he takes the axe in hand. The new settler clears in a year more acres than he can cultivate in ten, and destroys at a single burning many a winter's fuel, which would better be kept in reserve for his grandchildren. This profuse waste is checked, but it has not entirely ceased. It is, however, giving way to better views. Even since this survey was begun, a wiser economy shows itself. May it be universal. A brief consideration of the general uses of forests on a great scale may have a tendency to produce this effect.

USES OF THE FORESTS.

1. Forests create or gradually but constantly improve a soil. The roots penetrate deeply into the ground, and thus let in the air to produce its slow but sure effects. The radicles decompose the grains of sand, and extract from them some of the elements essential to a soil; they drink in moisture and the carbonic acid which has been formed beneath, or brought down from the atmosphere above, the surface; and from these several elements, acted on by heat, light and air, in the leaves, and by that unknown influence, vegetable life, are formed the various substances which compose the plant. The annual deposit of leaves, and the final decay of the branches and trunk, go to constitute the mould upon which other plants grow. And the soil thus formed is kept by the thick matting of the roots from washing away.

An unprotected hill soon loses its soil. Every rain bears away a portion, till it becomes a bare rock, and the slow process must recommence by which rock had been originally converted into soil. That process takes place slowly on all uncovered rocks, but far more surely and rapidly under cover of trees. There also the invisible sporule, borne thither on the wind, perhaps, from a distant continent, attaches itself to the naked rock and vegetates; encrusting its surface with a lichen which gets thence a foothold and an alkali, while it lives on the atmosphere. From the thin layer left by its decay, another species springs, which in turn gives place to mosses and herbaceous plants. Whoever has climbed Monument Mountain in Stockbridge, has had an opportunity of observing this process in its different stages and circumstances. On the projecting cliffs of white quartz, of which the mountain consists, the beautiful lichens which paint its sides have made no more progress than if the mountain had been thrown up two years ago. They are spread upon it as thin as paper, and perfectly fresh. Wherever they decay, the violence of the rain and winds washes them clean off, and the work is begun each year anew. But in the protected crevices, and under shelter of the few trees

and shrubs that have found root-hold there, a soil is forming or is already formed. What happens here takes place on all mountain tops in New England. A sheltering tree allows the creative action to take place.

2. Another use of forests is to serve as conductors of electricity between the clouds and its great reservoir the earth; thus giving activity to the vital powers of plants, and leading the clouds to discharge their contents upon the earth. A few tall trees on the summit of a hill are sufficient to produce this effect. A charged thunder cloud, which passes unbroken over a bare hill, will pour down its moisture, if its electricity is drawn off by these natural conductors. The dry sterility of some parts of Spain, anciently very fertile, is probably owing, in a great degree, to the improvident destruction of the forests, and the absurd laws which discourage their renewal. The forests also coat the earth and keep it warm in winter, shutting in the central heat which would otherwise more rapidly radiate into space and be lost. If you go into the woods at the end of a severe winter, you may any where easily drive down a stake without impediment from the frost; while, in the open field by their edge, you find a foot or more of earth frozen solid. Forests act not less favorably as a protection against the excessive heat of the summer's sun, which rapidly evaporates the moisture and parches up the surface. The first mahogany cutters in Honduras found the cold under the immense forests so great, that they were obliged, though within 16° of the equator, to kindle fires to keep themselves warm.* The rain, falling on the woods of a hill side, is retained by the deep and spongy mass formed by the roots and the accumulated deposit of leaves, instead of rushing down, as it otherwise would, in torrents, carrying with it great quantities of loose soil. Protected also from rapid evaporation, it remains laid up as in a reservoir, trickling gradually out and forming perennial streams, watering and fertilizing the

* "At Gniara, in South America, within 5° of the line, the inhabitants living amid immense forests, a century ago, were obliged to alleviate the severity of the cold by evening fires. Even the duration of the rainy season has been shortened by the clearing of the country, and the warmth is so increased, that a fire now would be deemed an annoyance."—*Ure's Dictionary of Chemistry*,—article, Climate.

low country through the longest summers, and moderating the violence of droughts by mists and dews. All along the coast of New England, numerous little streams, which were formerly fed by the forests, and often rolled a volume of water sufficient to turn a mill in summer, are now dried up at that season, and only furnish a drain for the melting snows of spring, or the occasional great rains of autumn.

Forests thus equalize the temperature and soften the climate, protecting from the extremes of cold and heat, dryness and humidity. There is little doubt that, if the ancient forests of Spain could be restored to its hills, its ancient fertility would return. Now, there is nothing to conduct electricity, nothing to arrest the clouds and make them pour their treasures upon the earth, no reservoirs to lay up the winter's rain in store against the droughts of summer.

3. Forests protect a country from the violence of winds. The lively author of "Life in Mexico" writes,* "M. de Humboldt, who examined the will of Cortes, informs us that the conqueror had left sugar plantations near Cuyoacan, in the valley of Mexico, where now, owing, it is supposed, to the cutting down of the trees, the cold is too great for sugar cane or any other tropical production to thrive." And a most intelligent gentleman in Worcester tells me, that he attributes the greater difficulty now experienced in the cultivation of the more delicate fruits in that town, to the fact, that the encircling hills, formerly crowned with trees, are now, to a considerable degree, laid bare. The laws of the motion of the atmosphere are similar to those of water. A bare hill gives no protection. The wind pours over it as water pours over a dam. But if the hill be capped with trees, the windy cascade will be broken as into spray. Its violence will be sensibly diminished. We are not aware, on the now protected and irregular surface of New England, how important are the screens furnished by the forests. Travellers from Illinois tell us, that on the vast prairies in that and some of the other western States, the wind is almost always fresh, and often blows a gale, before which men can hardly

* Volume II., p. 52.

stand. The new settlers are glad to shelter their habitations under the lee of the spurs of forest which stretch like promontories into the prairie lands. A forest near the coast, in any part of New England, protects those farther inland from the chilling east winds; and, while such winds prevail, a person passing towards the sea, experiences a marked change of temperature, upon crossing the last wood and especially the last wood-covered hill. One who would have his house screened from the northerly winds, must take care to have behind it a hill crowned with trees, or at least to have a wood stretching from the northwest to the northeast. A garden surrounded by tall trees admits the cultivation, even in our severe climate, of plants almost tropical.

Forests not only protect from winds; they must prevent their formation. The air resting over a broken surface cannot be rapidly heated to a uniformly high temperature, so as to rise upwards in great masses and create a violent wind.*

4. As adding to the beauty of a country, the forests are of the utmost importance. A country destitute of them cannot be in the highest degree beautiful. If the green hills of Berk-

* A writer in the 6th volume of the *N. E. Farmer*, says, "It is not merely in forests, nor as supplying fire wood and timber that trees are valuable. 'Considered agriculturally,' says an English writer, 'the advantages to be derived from subdividing extensive tracts of country by plantations are evidently great, whether considered in the light of affording immediate shelter to the lands, or in that of improving the local climate.' The fact that the climate may be thus improved, has, in very many instances, been sufficiently established. It is indeed astonishing how much better cattle thrive in fields even but moderately sheltered, than they do in an open, exposed country. In the breeding of cattle, a sheltered farm, or a sheltered corner in a farm, is a thing much prized; and in instances where fields are taken by the season for the purpose of fattening cattle, those most sheltered never fail to bring the highest rents. . . . Dr. Deane has observed, 'pasture lands should be well fenced, in small lots, . . . and these lots should be bordered at least, with rows of trees. It is best that trees of some kind or other should be growing scattered in every point of a pasture, so that cattle may never have far to go, in a hot hour, to obtain a comfortable shade.'"

"Small lots, thus sheltered, are not left bare of snow so early in the spring as larger ones lying bare; since fences and trees cause more of it to remain on the ground. The cold winds in March and April hurt the grass much when the ground is bare; and the winds in winter will not suffer snow to lie deep in land that is too open to the rake of winds and storms."—*N. E.*, VI., 350.

shire were stripped of their woods, they would be converted into broad reaches of upland, from which most of their beauty would have departed. The striking feature in that charming country is the old forest, on the sides of its hills, here and there irregularly broken in upon by cultivation. The northern and southern sides of Boston are not essentially unlike in their natural features; yet the hills of Brookline and Roxbury, capped with hickory, and whose sides are clothed with oaks and pines, give the impression of a rich and happy country, of which only pleasant memories are carried away, while the bare hills of Chelsea suggest images of bleak and barren desolation. Three or four trees upon Apple Island make it a gem among the islands in Boston Harbor. What a scene would the Bay present, if all the islands were so covered !

No element of beauty is so completely manageable as trees; and our resources in that respect are surprisingly great. Situated in the middle of the temperate zone, we have, in Massachusetts, all the best of the deciduous trees, the oaks, elms, beeches, ashes, hickories, walnuts, cherries, maples, the chestnut, linden and button-wood, of the temperate regions, together with the finest of the evergreens, the pines, firs, spruces, cedars and hemlock, and the delicate birches, of a more northern climate. Each one of these trees has its own peculiar and distinctly marked character, recognizable at a distance, and producing an effect which needs not to be mistaken for that of any other. Each has its own cycle of change, its own time of flowering, and of perfecting its fruit, and of opening, maturing, changing and casting its foliage. Each has its own shape and its own color, distinguishing it from every other tree, even of the species most nearly allied. Hence the endless variety of forest scenery. Here are more than fifty elements shading off and blending into each other in imperceptible gradations, according as you recede from the coast to the interior, as you go north or south, or as you rise from the plain into the mountains. We have here representatives of the vegetations of the warmer and of the colder regions; but as you go north, first the hickories, then most of the other nut-bearing trees, then others grad-

ually leave you, and give place to hardier foresters. As you go south, the same gradual change takes place from the desertion of the pines and birches, and the addition of new oaks, and other trees. Every one feels the difference in the effect produced on the mind by the forests of Berkshire, and the woods of Norfolk or Essex county. The practised eye detects the cause of the difference in the different trees which constitute the forest, and still more in the different proportions in which the same trees are combined.

These numerous trees and the still more numerous flowering shrubs which belong to our forests, all capable of being made to flourish freely in every part of the State, give the planter who is studious of the effects of landscape, inexhaustible resources. Some of the trees grow habitually to the height of only thirty or forty feet; others rise to seventy or a hundred. Judiciously grouped in planting, they are capable of giving to a level plain the appearance of any desired inequality of surface. The tall pines, elms and sycamores at a distance, will seem to occupy a hill, the hickories and maples, to clothe its sides, while the spreading beeches, broad oaks and hanging birches, will form the gradual descent to the plain. Among these, a winding path leading under or near the largest trees and behind thickets, may give to a few acres all the advantages of variety of a large forest.

To many persons, the pleasantest season in our climate is autumn, and to a lover of nature the rich and infinitely varied gorgeousness of the autumnal woods is a most important addition to the enjoyment of that season in the country. Each tree has its own color, or rather its own class of colors,—tints and shades which belong to it and to it alone. Trees to be planted about a residence should be selected in reference to this circumstance as well as to the time and variety of their flowering. Early autumn becomes gay with the vivid crimson of the tupelo and the sumach. A little later come out the rich orange and yellow of the sugar maple, with the gold and scarlet of the red flowering maple. The soft olive tints of the ash, the warm browns of the hickory, the purples of the *cornus florida*, the

buffs and yellows of the birches, give place at last to the full scarlets, yellows and browns of the oaks, many of whose leaves remain adhering through the snows of winter. These and forty other trees, and twice as many shrubs, furnish as inexhaustible a store-house of colors as they do of shape and foliage. It would be endless to speak of the adjuncts of trees, the climbing shrubs, the Virginia creeper, so remarkable for the richness of its fading colors, the Roxbury wax-work, for its berries, the ivy, the vine and the climbers which naturally attach themselves to our trees, and which may be trained upon them in cultivation; the lichens which cloud and paint their trunks with touches of green and yellow, white and brown, and the mosses of brilliant green or purple velvet which grow about their base. All these are studies for the landscape gardener, and their daily observation will add immeasurably to the pleasure of the contemplative man who dwells in or traverses the country in autumn with the eye of a painter, and the feelings of a poet, or with those of a worshipper of the Author of these beauties.

It is surprising how small is the number of trees necessary to produce a striking effect. Ten or twelve trees, fortunately or skilfully disposed on the sides or brow of a hill, are often sufficient to give it an air of richness harmonizing perfectly with a highly cultivated country. The happy effect of three or four trees on an island in Boston harbor has been already mentioned; a single one on Pettick's Island gives an agreeable relief to the eye. A single tree by a farmer's house protects it, and gives it a desirable air of seclusion and rest; as if it must be the residence of peace and contentment. One almost covets a house so pleasantly sheltered. While an unprotected, solitary house seems to shiver in the north wind, and we involuntarily wish for the inhabitants a more cheerful home. Why should not at least one tree be found growing near the dwelling of every man, even the poorest and humblest?

Nothing can better illustrate the variety of our forest trees, compared with the European, than a criticism of the learned Hallam upon a passage in Spencer's *Fairy Queen*. It is that in the first book where a shady grove is described, in which the knight and lady take refuge. The critic objects "to the stanza

enumerating as many kinds of trees as the poet could call to mind,—

“The sayling Pine, the Cedar proud and tall,
The Vine-propp Elme, the Poplar never dry,
The builder Oake, sole king of forests all,
The Aspine good for staves, the Cypress funerale,—

with thirteen more in the next stanza. Every one knows that a natural forest never contains such a variety of species.” The other trees mentioned are the laurel, fir, willow, yew, birch, sallow, myrrh, beech, ash, olive, platane, holm, maple; in all twenty. Now the forest nearest to Boston which has been left undisturbed, and it is within four miles of the city, in Brookline, contains, in less than half a mile’s space, the white pine, the red cedar, the elm, the large-leaved poplar, the white oak, the aspen-leaved poplar, called aspen by our ancestors, from its resemblance to the tree of that name in England, the willow, two or three species, the poplar-leaved birch, most near akin to the European, the ash, the beech, the plane, or button-wood, the red-flowering maple,—to correspond with those of the same name,—the hemlock, the tupelo, the spruce, the pitch pine, the alder, the shellbark, the hornbeam, the leverwood, to stand against the others named; and moreover the red oak, the black, and the swamp oak, the sugar maple, the yellow birch, the black birch, the square-nut hickory, the pig-nut, the bitter-nut, the chestnut, and the linden, all growing as they were planted by the hand of nature. If it be objected that it is unfair to enumerate several species of one genus, it may be answered that they are all quite as unlike each other as are the willow and sallow, or the poplar and aspen of Spencer’s catalogue. It is true that we do not often find in Massachusetts so great a variety in the same wood, except upon soil from the pudding-stone or conglomerate formation. The various ingredients of that rock seem to furnish the materials necessary for the ready growth of every kind of tree of our climate.

5. In a country so much exposed as ours is, in consequence of the remarkable clearness of the atmosphere, to the burning heat of the sun, the use of trees for shade is not one of the least

important. This use is closely allied to the last. A tree which furnishes a cool shade to the inhabitants of a house, is at the same time and on that account its best ornament. At the season when men travel for pleasure, a plain, low, modest house with an open grass plot before it, shaded by an oak or an elm, speaks more to the feelings and is more beautiful than the showiest house unprotected from the sun. The traveller in a hot day welcomes every tree on the road side. Even a thin fringe of grey birches looks pleasant; and he remembers thankfully the kindness or good taste which has spared, or planted a tree with a head broad and thick enough for him to rest under and cool himself.

Trees should be planted not only by dwelling-houses and along roads; they should be in every pasture and by watering places, and near every barn,—wherever cattle, horses or sheep are to be provided for. All these animals suffer from our burning sun; and, to say nothing of their enjoyment, the cost of shade trees will be many times paid back in the saving of the milk, fat, fleece and strength, which will be the consequence of their being protected from the heat of the sun.

6. The importance of the forests as furnishing materials for ship-building, house-building, and numerous other arts, is so obvious that it must occur to every one; and yet there is danger that, in many places, from false views of immediate economy, no provision will be made for the wants of future generations. It is not easy to estimate the pecuniary value of the wood used in house-building. A vast deal of this is continually going on; the aspect of the State is annually everywhere improving by the erection of larger, better finished and more commodious houses, barns and outhouses. And almost all the materials have been, hitherto, except for the sea-board towns, furnished by our own woods. But no returns of these improvements are published. The thousands of tons of timber, boards, clap-boards and shingles, are not put on record. It is manifest, however, that the difference against us would be great, if we had to look elsewhere for our materials. It is indeed very desirable that better taste and more just views of economy, should introduce the fashion of building dwelling-

were directly employed. Probably five times that number depended on it for support.

If to this we add a fair proportion for the materials used in the making of boats, spars, pumps and blocks,

<i>f</i>	32,391	dollars;
“ “	scythe-snaths, scythe-rifles, &c. <i>g</i>	44,736 “
“ “	brushes, brooms and baskets, . <i>h</i>	289,512 “
“ “	carriages, wagons, sleighs, harness, &c. <i>i</i>	679,442 “
“ “	machinery, <i>j</i>	1,235,390 “
“ “	ploughs, <i>k</i>	54,561 “
“ “	saddles, trunks, and whips, . <i>l</i>	351,575 “
“ “	shovels, spades, forks and hoes, <i>m</i>	264,709 “

making, in all, the sum of 2,952,317 dollars;
giving employment to *f.* 53, *g.* 88, *h.* 350, *i.* 945, *j.* 1399, *k.* 73,
l. 758, *m.* 284,—3950 persons, and support, to doubtless, five
times as many. If the wooden materials be estimated at 1-10th
part of the final value, we have 295,231 dollars
to add to the 1,881,589 “

found above;

making, in all, the sum of 2,177,820 dollars
besides the value of the proportion of wooden materials enter-
ing into the building of ships.

The effects of the wasteful destruction of the forest trees are already visible. A very large proportion of the materials for ship-building, house-building and manufactures, in the towns along the coast, are now brought from other States. The manufacture of wooden bowls and other vessels made of a single piece, has in some towns in Berkshire diminished, and in others been given up, from the failure of ashes, beeches, lindens, and other suitable trees large enough for the purpose; and in the western towns of Worcester county, materials less valuable than heretofore are necessarily in some cases used in the important manufacture of chairs. The same thing is taking place, almost imperceptibly, in all parts of the State. Every mechanic, who works in wood, looks every year more and more out of the State for his materials. Every year we are more dependent on Maine and New York, and some of the southern States, not

only for ship-timber and lumber for house-building, but for materials for tanning and dyeing, for carriage-making, basket-making, plane-making, last-making, and for furniture and the implements of husbandry.

Even these foreign resources are fast failing us. Within the last quarter of a century, the forests of Maine and New York, from which we draw our largest supplies, have disappeared more rapidly than those of Massachusetts ever did. In a quarter of a century more, at this rate, the supply in many places will be entirely cut off. In many parts of both those States, which recently furnished the most abundant supplies, agriculture is already taking the place of the lumber trade; and the disforested region, now changing into beautiful farms, will never be allowed to resume its original wildness; or, if the attempt should be made, to restore the forests, the experiment would require a hundred years.

7. Another special use of the forests of the State, is in the production of maple sugar. Great quantities are already made, and the manufacture might be much more generally introduced. This subject has already received considerable attention. It deserves much more. In many favorable situations, the cultivation of the maple tree would cost only forethought. The labor of planting the trees might be performed late in the year, when the fall work was over, and the making of sugar be attended to early, before the spring work had begun.

Of minor importance, but of much more than is usually given to it, is the production of nuts of various kinds, the fruit of forest trees. The produce of the shellbark, chestnut, beech, hazel, and acorn, already valuable, might be increased in value almost indefinitely, by selecting the best native varieties, and improving them by processes similar to those to which we owe the fine varieties of apple and pear, and the cultivated varieties of European nuts, and by introducing similar trees, such as the pecan nut, the English walnut, and the European hazel.

8. The most extensive and important use of the forest is in the fuel it furnishes. Most of the fires, through the State, are still chiefly fed from this source. The population, by the last census, was something over 737,000. Now, it has been found

that in England, the country most like ours, a family consists, on an average, of 4 7-10th persons. From the greater facility of procuring subsistence, marriage takes place earlier among us and families are larger. If we suppose them to average 6 persons, there are about 123,000 families in this State. If we suppose the average to be 7, there are more than 105,000 families. The prices of fuel vary very considerably in different parts of the State. The estimates of value that have been sent me, give not far from four dollars as the average price per cord of hard wood.* The quantities required for a family's fuel for a year, are very variously estimated. The medium is between 13 and 14 cords. If we suppose the price to be only \$3.50, and the quantity required for a single family to be only 12 cords a year, the average cost of fuel for each family will be found to be \$42. If there are 123,000 families in the State, the annual expense will be \$5,166,000. If we suppose only 105,000 families, the expense cannot be less \$4,410,000. It would not be easy to ascertain the quantity of fuel used in the schools, work-shops, and furnaces in the State.

The quantities consumed in the locomotives on the rail-roads, may be more nearly ascertained. The annual average quantity consumed on the Boston and Worcester Rail-road, for the last two years, is nearly 8000 cords, at a cost of somewhat more than \$31,000 per annum, or about \$3.92 per cord. The average quantity consumed on the Western Rail-road, between Worcester and Albany, is 18,000 cords, at a lower cost per cord. The quantity used on the Boston and Providence Rail-road in 1843, was something over 4000 cords, at an average

* I have letters from intelligent gentlemen in all the counties, giving the prices of hard wood in their several towns, and the average number of cords necessary for a single family. Stating these prices below the estimates given me, I set the price in Berkshire at \$2 ; in Franklin, Hampden and Hampshire, at \$3 ; in Barnstable, Bristol, Essex, Middlesex, Norfolk, Plymouth and Worcester, at \$4 ; in Nantucket and Dukes, at \$5 ; and in Suffolk at \$6. Taking the inhabitants of the several counties, according to the census of 1840, I obtain the average price of \$4 03 per cord, for the whole consumption by families. The quantities necessary for a family's use, are stated by my correspondents at all numbers, from 4 to 30 cords or more. The numbers given me by the fifteen persons most to be relied on, are 4, 6, 6, 8, 9, 10, 10, 11, 15, 16, 17, 17, 20, 20, 30. The average of these is 13 and nearly 3 tenths.

cost of nearly \$4.50, making \$18,000. The average annual consumption on the Boston and Lowell road, is 4000 cords, at an average first cost of about \$3.50 per cord,—\$14,000. The average consumption on the Boston and Maine Rail-road, is about 8000 cords, at an expense of about \$17,000, about \$2.13 per cord. A considerable portion of this road lies in New Hampshire and Maine, and the wood is procured almost entirely from those States. On the Eastern Rail-road, as far as Newburyport, there are used, besides coal, 2400 cords of wood, at the rate of \$4.50 per cord, an expense of \$10,200. Now, taking one-half the Boston and Maine Rail-road to run in Massachusetts, we have, on the six most travelled roads, an annual consumption of 40,400 cords of wood, at an expense of \$135,700 for 338 miles, or about 120 cords per mile. Of the other rail-roads, the Taunton is 11 miles long, the New Bedford 21, the Fall River 11, the Nashua 14, the Northampton 23, the Berkshire 21, the Fitchburg 42, the Plymouth, soon to be completed, 38. The Norwich runs, in this State, about 20; the Hartford, in this State, about 8; the Hudson and Berkshire, in this State, about 13;—in all, 222 miles. Suppose the average consumption on these roads to be one-half what it is on the others, or 60 cords a mile, and the price of wood \$3.25,—we have 13,320 cords of wood consumed, at an expense of \$43,290. These, added to the sums above, give an annual consumption of 53,710 cords of wood, at an expense of \$178,990 for 560 miles of rail-road, an estimate which those acquainted with the subject will regard as within moderate bounds. The wood consumed in locomotives is almost entirely pine of some kind. Very little hard wood is used for the purpose. Now, this consumption is not likely to diminish, and offers a permanent market for all the pine wood which can be grown.

CONTINUATION AND IMPROVEMENT OF THE FORESTS.

From all these considerations, it is apparent how valuable are the forests, and how important it is that efforts should be made, by the land owners of this generation, to check the waste which is going on, and to provide supplies for the wants of the generations to come. Planting trees on a large scale has been sel-

dom attempted in New England. The inhabitants of each town have been content with the kinds of wood growing in their neighborhood; or, where particular kinds, not to be found there, were necessary for the manufactures already established, they have been satisfied to import them from a distance. In very few instances, have systematic efforts been made to provide a future supply of the best materials, in their own immediate vicinity. This is to be done. The individuals interested in a particular branch of manufacture in wood may say, that when materials fail them in one place, they will go to another. The owners of the land ought not to rest satisfied with this view of the case. True patriotism and enlightened views of economy, ought to prevent any one from consenting to it.

Massachusetts must necessarily continue to be a manufacturing State; and the manufactures in wood are among the most important branches of industry, and must be not only continued but enlarged. They cannot even continue, unless pains are taken to plant forests which shall furnish the necessary materials. A manufacturer of wooden bowls and trays in Boston, who had procured his materials from Maine, found that it would be better economy to live near the woods which produced them, and send the finished articles thence to market. When the large ashes and beeches of Becket are cut down, the maker of wooden-ware must remove to an older forest. What takes place in individual cases, indicates the necessary but silent movement of great masses. One by one, the workers in wood will have left the State, when the old forests shall have been all cut down. A prudent foresight may prevent this, by planting, in season, the kinds of trees necessary for these various demands,—for fuel and for all the branches of manufacture. For this end, we have extraordinary resources. Among the native trees, we have great choice, from the number, variety, and excellence of the species. In the narrow breadth of Massachusetts, the species of native timber trees are more numerous than are found in any kingdom of Europe. We have nine large oak trees, four hickories, five birches, three large maples, three ashes, three pines, two walnuts, two elms, two spruces, two cedars, besides the beech, the chestnut, the hornbeam, the lever wood, the tupelo, the hoop

ash or nettle tree, the tulip tree, the plane, the bass, the locust, the hemlock, the fir, the hachmatack, the cherry, the holly, several poplars, many willows, and a large number of smaller trees. Besides these, it is found that all the valuable trees of middle and northern Europe flourish here as if they were native. It thus appears that our soil and climate are perfectly well adapted to all kinds of wood which are found in temperate countries. It is only necessary to understand the character and habits of each, and to choose suitable soil and situation.

Of many of our trees the properties are but partially known. Some of them grow only in particular districts. Others are so unlike those found in the mother country, that they hardly have a name.* Of many, the habits and rate of increase, and the soil, exposure, and situation most favorable to their growth, have not yet been studied. Of the nine large oaks found growing in Massachusetts, not more than five are often found in the same forest, and of these, two, and often three, are not well distinguished by the land owner, though their value for different purposes is very different. The black oak and the scarlet are commonly confounded, from their close resemblance, although, to the ship-builder or the wagon-maker, the former is far the more valuable; and both these trees are often confounded with the red oak, which, for timber or fuel, is comparatively worthless. The rock chestnut oak, of great value for fuel and for timber, and better adapted, than any other oak, for growth on rocky hills, is well known in only a few towns in the State. The mossy cup oak, so valuable for trenails and small frame work, is found only in a small part of Berkshire. It would grow readily in any section. The rough oak, or post oak, is now known only on Martha's Vineyard. Similar observations might be made on half the trees in the State. Those most interested in the subject, the owners of the land which should be devoted to trees, and the mechanics who work on the wood, are seldom acquainted with the qualities of any except the trees of their own immediate vicinity.

* There is no one uniform name for the *Celtis*, the *Carpinus*, the *Ostrya*, or the *Nyssa*.

Nature points out, in various ways, and the observation of practical men has almost universally confirmed, the conclusion to which the philosophical botanist has come from theoretical considerations, that a rotation of crops is as important in the forests as it is in cultivated fields. A pine forest is often, without the agency of man, succeeded by an oak forest, where there were a few oaks previously scattered through the wood, to furnish seed. An oak forest is succeeded by one of pine, under the same conditions. But it frequently happens that there are not enough trees of the opposite family to seed the ground: in which case a forest will be succeeded by another of the same kind, which, though it will grow, will probably not flourish with the same luxuriance as would one of another family.

It will not be considered foreign to our purpose to enumerate some of the more important of the objects which should be kept in view, in the cultivation and extension of our forests, and the native and foreign trees best suited for those purposes.

The first want, as has been shown, is fuel. The trees best suited to the purpose are the hickories, the oaks, the beech, the birches, the maples, and the pines, particularly the pitch pine, and the chestnut and hemlock for close furnaces. If fuel is to be used in the form of charcoal, the hard woods only are of great value, particularly chestnut, the birches, alders, oaks and maples. As materials for house-building, the pines, the spruce and the hemlock are generally employed. White oak was formerly used for frames, and in many houses now standing for more than a century, it has not begun to decay. Chestnut resists decay, and is more and more in use. Floors are sometimes made of beech, of birch, and of ash. The best materials, probably, are oak, white pine, chestnut, and spruce.

For ship-building, oak is considered absolutely necessary, as being preferable to any other wood. The best kinds are white oak, and black, or yellow bark oak. Much southern oak is now used. The English oaks, which, in Great Britain, are preferred, may be cultivated here as successfully as our own oaks. In the construction of most of the ships of Europe, great quantities of larch are used. This tree might be profitably planted on thousands of acres which are now unproductive. Small ves-

sels, remarkably light and durable, have been wholly made of pitch pine. This tree grows well on sands so barren as to furnish nourishment for no other tree. Pitch pine is also used in preference to other timber for the upper works of large vessels, and for top-masts. White pine is also used; especially for decks, as it retains the oakum in its seams; and for knees, haematack and spruce; and rock maple for keels. The durability of all kinds of wood under salt water, is considered nearly or quite equal. Spruce and pine are also used for the upper spars. For boats, cedar and oak are necessary.

For fencing materials, chestnut and cedar are found most durable. The former is remarkable for its rapid growth. White cedar grows luxuriantly in wet swamps where nothing else will flourish. The various native and foreign thorns, the hemlock, red cedar, and numerous small trees, furnish fit materials for hedges, which, in many parts of the State, must ultimately take the place of other fences.

Furniture, of the most ornamental kinds, is now made of our beautiful maples, birches, cherries, and beech. Tables of extreme beauty are sometimes made of the root of oak, or maple, or birch. These four trees, with the oaks and pines, must continue to be indispensably necessary for the manufacture of chairs, tables, bedsteads, and other kinds of furniture.

For implements of husbandry, the ashes and hickories, the lever wood, the hornbeam and the oaks, must always be wanted. The carriage-maker and wagon-builder will want ash for springs and frames, oak for spokes and fellies, elm for hubs and white wood or bass for pannels. The basket-maker will want young white oaks, ash and willow; the plane-maker, beech; the last-maker, maple; the pump-maker, oak and pitch pine; the bucket-maker, white and red cedar.

The tanner will continue to want the bark of the black, the white, and the chestnut oak, the hemlock and the birch, in regard to materials from all which there has hitherto been great wastefulness. And the dyer will want quercitron, sumach, barberry root, in addition to foreign stuffs, for some of which he might substitute the bark of alder, birch, and some other native trees.

IMPROVABLE LANDS.

For all the above purposes, the forests are of vast immediate and prospective importance. A knowledge of the best and most economical means of managing and enlarging them, is no less important.

According to the latest returns, the woodlands of Massachusetts cover 729,792 acres. There are, besides, 955,000 acres of unimproved lands, and 360,000 reported as unimprovable. In all, there are 2,044,792 acres not occupied by buildings or cultivation, out of the 4,491,812 acres which are estimated to constitute the whole territory. Probably the whole of the unimproved and those called unimprovable lands, might be turned into forest; as it is very questionable whether any land, except the ocean beach, should be considered unimprovable. The least promising kinds of surface are, that covered with loose, drifting sand, that of bare, rocky hills, and that of marshes covered with sedge.

The most barren sands along the sea-coast of France have been successfully sown with pines. Of the details of the process, an account will be given in the chapter on trees of that family. No part of the sandy territory of Massachusetts, is so hopeless as the region which has thus been actually converted into forest. Our climate is quite as favorable as that of France to the growth of evergreens. We have, among our native trees of that family, a much greater variety, and we may avail ourselves, if necessary, of the very kind of pine so successfully experimented upon in that country.

Many acres now under cultivation, and poorly repaying the labor spent on them, might be advantageously sown or planted with pines.

The most impracticable of our rocky hills were originally covered with trees. Sufficient portions of them remain in that state, to show that all might, with a little pains, be redeemed to a productive use. There are several kinds of trees which require very little soil; some of them need little more than a foothold in the earth. Several oaks, birches and pines, are often

found growing among rocks where no soil can be seen. The rock chestnut oak, the black birch, the red cedar, and the Hacquatack, rejoice in such situations. As in the case of the sands, the experiment has been made, on a large scale, of covering bare, bleak hills, with trees. Of the Duke of Athol's successful experiments in Scotland, on thousands of acres of worthless, rocky hills, an account will hereafter be given, as also of the value of the forests thus created.

Of sedgy marsh and swamp, too wet and cold to be cultivated without extensive and costly draining, many acres in the eastern part of the State have been sown by a natural process with the seeds of the white cedar. The seeds, when shed, float upon the water, and are carried by spring tides and freshets, and left upon the surface of the ground. In the summer, they spring up in countless multitudes. They may now be seen in different states of forwardness, some of them forming impenetrable thickets. What has been done, in these instances, by nature, indicates the process by which similar grounds may be reduced or restored to the condition of forest.

By means of the trees above mentioned, and others, almost every acre of the surface might be made productive. Even the rocky crown of the sea-beaches might be covered with beach plums.

Much is to be done for the improvement of the woodlands now existing. In some cases, they are managed with great care. The best means of thinning, pruning, and felling, are studied and practised. But, in many cases, indeed in most instances, they are left in utter neglect. The consequences are often very visible. In the cedar swamps just spoken of, the seed-sowing has been so profuse, that plants spring up thick enough to almost cover the ground. Ten or twelve may sometimes be seen on a square foot. These grow up well together for a year or two. Afterwards, they seem to be struggling for existence. The growth of all is retarded—almost stopped. In a few years, the strongest overtop the others, which gradually die. Still the number left living is far too great for the ground, and few of them become fine and vigorous trees. All the side branches die for want of light and air, and the top-most shoot,

never sufficient to form a shapely tree, is left alone. The same thing takes place in beech groves. Ten or twenty times as many plants spring up as can be sustained. They go on together vegetating, but hardly growing. I know several instances of beech woods, which have made no perceptible progress for twenty years. These are the most striking cases; but forests of other trees are almost constantly, if left to themselves, affected in a similar manner.

The remedy is obvious. Every year, from the first, they need to be thinned. For the first few years, the plants removed are of no value except for transplantation or fuel. Afterwards, they are of use, in innumerable ways; the young cedars, larches, and chestnuts, for stakes and poles; hickories for walking-sticks; oaks and ashes for basket-work; lever-wood and hoop-ash for whip-stocks and levers; all of the five latter for hoops. The products of the thinning will thus obviously far more than repay the labor, even if this were not necessary for the welfare of the remaining trees.

THINNING AND PRUNING.

The *principle* on which pruning and thinning should be conducted, is a very plain and intelligible one. It is, that every tree and every branch should be allowed to have an ample supply of air and light. When, therefore, two trees are so near, that their branches extensively intermingle, one should be removed; and, generally, it should be that one which is much taller or shorter than the neighboring trees.

In pruning, that branch should be shortened which encroaches on other branches of its own or another tree. It should not be cut off close to the stem, as, in that case, the wound will be long in healing, and the root* which supplied the branch, being left useless, will wholly or partly perish, and, by its decay, will

* "It is almost universally found, that a large branch corresponds to a large root, and the reverse; and this is true, whether the root, placed in favorable circumstances, determines the growth of the branch above it, or the branch, propitiously situated, causes the growth of its corresponding root."—*De Candolle, Organographie Végétale*, Tom. I., p. 162.

infect and weaken the whole tree. It should rather be taken off at the distance of a foot or more from the stem, just above a vigorous shoot, which shall be left to grow towards a space in which it will find a plentiful supply of air and light. The shoot thus left will sustain the life of the shortened branch, and will continue in action the root by which it had been nourished.*

The mode of thinning and pruning, will be governed in some measure by the end in view. If the object is to produce a full grown tree, in its true character, developing itself according to its natural tendencies, all or most of the branches will be left, and care be taken to give them space; and, as every branch swells the trunk, a similar course will be pursued, where it is an object to get the greatest possible amount of wood. In both cases, those stems and branches only will be removed, which interfere with the rest. A crowded growth will be allowed, and the lower lateral branches will be removed, where it is desirable to get a lofty trunk and head.

In many hard wood trees, shoots spring vigorously from the stool or stump, after the trunk is cut down; and this mode of reproduction is chiefly relied upon in most of the woodlands in the State. It becomes, then, of great importance to ascertain what are the best modes of felling, whether by thinning out the forest or cutting it entirely down; in what period a wood, so cut down, will renew itself, so as to be profitably cut again; at what age of the tree the stump will shoot most vigorously; at what age, if any, trees cease to shoot from the stool; what trees will not thus shoot; what season of the year is found best for felling a forest, when the object is to have it renew itself speedily; and what season, when the object is to destroy the forest. In 1838, I addressed circulars to gentlemen interested in the forests, in all parts of the State, asking these questions and others. In answer, I received many communications, from which I now proceed to extract some of the valu-

* See a "Treatise on the Management and Cultivation of Forest Trees. By John Smith, Gardener and Forester to the Earl of Bute." The chapters on thinning and pruning are interesting, as giving illustrations, by a practical man, of scientific principles which he had learnt only from observation.

able conclusions of the observation of intelligent, practical men. Most of these conclusions are confirmed by the concurring testimony of great numbers of persons.

The ninth question in my circular, was, "In felling for timber, or for fuel, is it the practice to thin out the forest, or to cut it entirely down, and leave it to spring up from the stumps? Which is considered preferable?"

From the answers returned, I find that, in felling for timber, the practice is to select suitable trees, from any part of the forest. No instances have come to my knowledge of extensive woods, cultivated with express reference to the production of timber. In felling for fuel, the practice *has been* to select the old and mature trees, especially such as have begun to decay. It has now become nearly a universal practice to cut clean and close. Experience has uniformly shown this to be most economical. Several of my correspondents have subjoined the reason. One of them* writes,—“Trees which remain where woods are thinned, are much shaken by the winds, and often destroyed. Again, unless the timber be all or nearly all taken off, the new growth is shaded, sparse and feeble. But where a new forest springs up, it accommodates itself to all circumstances of wind and tempest.” Another† says,—“Some persons in this town have trimmed up young white oak and walnut (hickory) woods, clearing the undergrowth, when the wood itself consisted of young shoots of 10 or 12 years of age. The result of this experiment does not seem to justify a continuation of the practice.” Experience here seems to confirm a well known principle, that the quantity of wood formed depends upon the number of the branches, or rather upon the extent of surface of the leaves. To the question,—“How soon will a wood, which has been cut entirely down, renew itself so as to be profitably cut again?” the answers are very full and satisfactory, though very various. The object is every where supposed to be fuel. Some give a definite period, varying, for different places, from 15, 17, 18, 20, to 25, 30 and 35 years. The average of

* William Bacon, Esq., of Mount Osceola, Richmond.

† Austin Bacon, Esq., of Natick.

ten such is 23 years. Others speak less definitely, from 15 to 20, 17 to 30, 20 to 25, 20 to 30, 20 to 33, 20 to 40, 25 to 30, 25 to 35, 30 to 35, for woods of miscellaneous growth. The average deduced from fourteen such statements, is, from 21 to 28. The general average from all is a little over 24 years. These statements are probably as definite as the case admits. Differences of situation, exposure, soil, and kind of trees, would of necessity lead to them. For particular trees, the answers are more precise. The white or grey birch is of most rapid growth, and springs at once from the stump. This may be profitably cut in from 10 to 20 years; a growth of maple, ash and birch, black, yellow and white, in 20 to 25; oaks in from 20 to 33. Where the trees are principally oak, white, black and scarlet, the forest may be cut clean three times in a century. Cedar swamps, which grow from seed, cannot be profitably cut in less than 40 years. Pitch pines, which also spring only from seed, are very slow at first, and require from 40 to 60 years to be in a condition to be felled. In many places, the experiment has been tried of burning over the surface, ploughing, and sowing with rye. When the trees have been of hard wood, this practice is strongly condemned. In the case of the pitch pine, it is recommended. The seedling pines make much more rapid progress when the surface has been softened by cultivation.

An intelligent gentleman of great experience, A. M. Ide, Esq., of South Attleborough, gives me a statement of some important facts bearing upon the subject. "Having been, for thirty years past, more or less engaged in buying woodland and cutting it off, I wish to state that I know, from careful observation, that an acre of good land, where there is a mixture of the several kinds of oak and walnut, (hickory,) cut off while young and thrifty, will produce, during the first 20 or 25 years, a cord of wood yearly." "I believe that most kinds of hard wood are worth twenty or thirty per cent. more, for fuel, at the age of 25 years than at 75." This important fact is confirmed by many of the wood-growers in the Old Colony, and in other parts where the woods have been repeatedly cut down. It is remarkable that all the facts and testimony lead to the same conclusion. The trees best for fuel shoot again most readily and vigorously

when cut under 25 years. The wood is formed within that time as rapidly, taking a forest together, as at any other age; and, for fuel, it is then of most value.

In cutting with a view to future timber, the tree should be felled as close to the ground as possible, as the shoots will then be erect. In cutting with a view to fuel, it is of less consequence. Several suckers will be thrown out, all of which will be curved at base, but they will all, thereby, have more room to grow.

To the questions,—“Stumps of trees of what age, when felled, will shoot up most vigorously? Is there any age at which they cease to shoot? What trees will not shoot from the stump?” the answers are equally full. To the first of these questions, the uniform answer is, that the stumps of young, healthy, growing trees, shoot most vigorously. They should not be under 15 years, nor much over 20. The almost uniform answer to the second question, is, that shoots will not come from very old trees. From those of old trees they spring up, but die in one or two years. Stumps of trees that had begun to decay, seldom give any shoots. In some cases, suckers come from the roots of old trees, but not from the stump. A single individual thinks that the power of throwing up shoots from the stump, never ceases during the life of the tree.

As to the third question, all agree that evergreens never give permanent shoots from the stump. Several persons, who have attended to the growth of the sugar maple say, that the stump of this tree makes no shoots; and the same is said of the beech.

As to the season of the year most favorable for felling a forest, when the object is to have it renew itself speedily, the testimony is various, but not absolutely discordant. All agree in saying, that the tree should be felled when not in leaf. The majority say, generally, in the winter months; some, between November and April. A correspondent in Plymouth, my friend G. P. Bradford, who kindly took great pains to get information extensively from the wood-growers in that neighborhood, says,—“It is generally considered, by those well acquainted with the matter, much preferable for the future growth, to fell a forest in April and May. The wood is not so good as when cut between

November and April." This is confirmed by several other persons who have enjoyed means of extended observation. The convenience of the wood-cutter will generally lead him to fell the forest in the early part of winter; and, probably, taking into consideration both the quality of the wood cut, and the welfare of the future forest, this may be best.

When the object is to destroy the growth, summer is universally declared to be the best season to fell a forest. As to the month, opinions differ. Many say, August, or late in summer; some say, June and July, or midsummer. Mr. A. C. Metcalfe, a very intelligent farmer of Lenox, says,—“In August, or when the tree has attained its full growth for that season.” This seems to be the true period, at whatever time it takes place; when the wood is formed and before it has hardened, and the materials are laid up, in the trunk and root, for future growth. Mr. A. Bacon describes a conclusive experiment. “A gentleman residing in this vicinity, effected the clearing of a lot of young walnuts, (hickories,) oaks and birches, in the following manner. He commenced cutting about the first of March, and felled successive portions as he found leisure, till about the first of July. That portion which was cut between the 18th and 30th of June, was killed to the letter. Those which were cut before the leaves put forth, were most prompt in the renewal of their sprouts.”

I find an opinion very generally expressed or implied, that every tree has a period of growth, maturity and decay. This is apparently hostile to the theory universally received by the vegetable physiologists, that the growth of every exogenous* tree, is, by its nature, indefinite. The discrepancy admits of being easily reconciled. Throughout Massachusetts, in the land left in forest, the soil is thin and poor. It will, therefore, in a comparatively short period of years, be exhausted of the nutriment essential to trees of any particular species. Every tree, like every other organized being, must perish when deprived of its necessary food. It is not surprising, therefore,

* All the common trees of our climate are exogenous, that is, they annually form a layer of new wood between the old wood and the bark.

that, in many soils, the trees should at last be unable to obtain sufficient nourishment, and should consequently thenceforward begin to cease to grow, and finally perish from inanition. We do not find this taking place on our rich intervalles, and it might every where, probably, be prevented by supplies of fresh, nourishing soil. The proper inference, therefore, from the fact that trees are dying on the ground, is, that their appropriate nourishment is exhausted, and that, if the ground is to be continued in forest, it should be sown or planted with trees of some other kind.

This is clearly indicated by what is constantly going on in the forests, particularly the fact which I have already stated, and which is abundantly confirmed by my correspondents, that a forest of one kind is frequently succeeded by a spontaneous growth of trees of another kind. Mr. P. Sanderson, of East Whately, writes me, "There is an instance, on my farm, of spruce and haematack being succeeded by a spontaneous growth of maple wood." Mr. Metcalfe, of Lenox, says,—“A forest of beech and maple is now growing on my father's farm, where stumps of white pine and some of oak and chestnut, are very numerous and very large.” Oaks and pines most frequently succeed each other. Mr. E. Swift, of Falmouth, writes,—“Many instances have occurred in this town, of pine lands having been cleared of the pine timber, which has been succeeded by a spontaneous growth of oak.” J. H. Cobb, Esq., of Dedham, says,—“I have known pine succeeded by hard wood in several instances.” Mr. S. Freeman, of Brewster, declares,—“I have known frequent instances, where a forest of oaks has been entirely cut down, and succeeded by a growth of pine, and vice versa.” Mr. W. Bacon, of Richmond, writes,—“We have seen hemlock succeeded by white birch in cold places, and by hard maple in warm ones; beech succeeded by maple, elm, &c.” I have many similar statements from all parts of the State. Indeed, the Hon. D. P. King, of Danvers, tells me that the fact is so universally admitted, that he is surprised at my asking the question.

This alternation is not, however, universal. In order that it

should take place, the woods must contain trees of various kinds sufficient to supply the whole surface with seed. When this is the case, a wood of one kind will usually be found full of little trees of other kinds. "Upon clearing off the old growth, the undergrowth, which has been kept from the sun, shoots up with astonishing rapidity." * That portion of it which is most unlike the previous growth, finds plentiful nutriment, while the proper food of the previous forest has been exhausted, and the woods naturally change their aspect.

The forests, as has been stated, form or improve a soil. This they do by their annual deposit of leaves, and by rendering the ground accessible to air, by the action of their roots. Both operations are essential, and aid each other. If the leaves were not deposited, the surface of the ground would speedily become dry and hard, and the radicles which had previously pervaded it, would be exposed to cold in winter, and to heat and drought in summer. The covering of leaves protects against all. By them the superficial portions are kept moist and soft, and permeable by the delicate radicles, and these are protected, while they are made readily accessible to moisture from rain charged with carbonic acid, and to air and a tempered warmth. The covering of leaves thus secures all those circumstances which are most favorable to vegetable growth. It is, therefore, justly enumerated, by some of my correspondents, among the things most unfavorable to the growth of trees, to gather the leaves together, as is frequently done, either to burn them or to add them to the compost heap. This is bad economy. It is double robbery. It is taking from the forest what belongs to it, and is almost essential to it, and it is spreading, with loss of time, upon the present cornfield, what, left undisturbed, is at once a store-house and laboratory of manure for the future cornfield, on which it is already spread and spreading itself.

The other circumstances enumerated as particularly unfavorable to the growth of trees, are browsing, pruning, a thin soil, exposure to sea breezes, to high winds, and to frosts.

* Mr. A. Bacon, of Natick.

The first of these, completely within the control of the forester, is the browsing of cattle. This is highly injurious to a forest in every state. It is destructive to the young trees, to the lower branches of taller trees, and to the undergrowth, which, in an old forest, is the hope of the future. Sheep and horses are not less injurious than cattle. All should be entirely excluded from woodlands intended to be valuable as such, and to renew themselves.*

I have already spoken of pruning. Where the object is wood, it may be doubted whether any pruning is advisable, except in the case that a branch of one tree materially interferes with the growth of another. Plants receive food by their roots, and digest and convert it to their various products, by and in their leaves. Both roots and leaves should therefore be left to extend and expand themselves as freely as possible; the one to occupy all the space just below the surface of the ground, the other to gain all the air and light within their reach above. Whatever checks this free expansion, has a tendency to lessen the product of wood.

On thin soil the roots cannot penetrate far, and a tree, surrounded by others, will soon exhaust the proper nutriment within its circle, and must then begin to fail. As soon as this happens, it must be removed, and trees of other families must be sown or planted in its stead. The proper treatment for thin soils, is, therefore, a rapid alternation of crops.

Most forest trees are injuriously affected by the sea-breeze, and we generally find them stunted and dwarfed by its influence. The remedy is to plant numerous the hardiest trees along the seaward border. Those that most successfully resist the sea-breeze, are the sycamore or plane tree, the linden, the poplars, particularly the balm of Gilead, and many of the pines. Almost all trees may do it when growing in large masses.

* Where a forest is to be renewed artificially, and where the trees are out of the reach of cattle, there is no objection to their grazing among them. One considerable recommendation of the Duke of Athol's mode of redeeming lands by planting larches, is, that the ground is improved for pasturage by the growth of grass under the shade of the trees.

The effect will then be less and less,—rapidly diminishing as you recede from the sea. On the capes and headlands projecting into the Atlantic, along the coast of Massachusetts and Maine, and exposed to the terrible northeast winds, the undisturbed original forests, when half a mile wide, have in the middle as large trees as are due to their depth of soil.

It is often very difficult to make trees begin to grow near the sea; sometimes it is impossible, without protection. But a low wall of loose stones, seaward, is sufficient to protect young trees near it until they get a little higher than the wall. The successive rows inland will be better and better protected, and will rise each higher than the preceding; until, at the distance of a few rods, they may rise to a tolerable height. When a belt of trees is once established, in such a situation, it should be kept undisturbed as long as it will serve the purpose of protecting the trees within, though it may be of no other value.

A course altogether similar should be taken in planting a much exposed hill. By beginning at the bottom and gradually planting upwards, the top may at last be clothed; as every belt of trees of a few feet in height, will protect a younger one a little higher on the hill.

Wherever trees are planted for use in the arts, it is important to give them the most rapid growth possible. Of wood growing on the same soil, that which grows most rapidly is strongest. That of which the circles of growth are narrowest is also weakest.* This fact is familiarly known to ship-builders, makers of lasts and of trenails, and of all those articles which require great strength. The reason is obvious. The circles of annual growth are separated by zones of loose, porous structure and inferior strength.

The strength of wood is proportioned to its weight. And as

* Buffon, II., 307. A circle of wood is annually formed on the trunk of a tree, between the outer previous circles and the inner bark. The space intervening between the annual circles or layers, is loose and porous, and contains very little solid substance or strength. The more frequently, therefore, these weak spaces succeed each other in a given thickness of wood the less must be the solidity and strength of the wood.

young trees grow more rapidly than old ones, they are more valuable as fuel. Round wood of oak or maple gives more heat than that which is so large as to require to be split. This fact shows the wastefulness of burning on the ground the undergrowth and the trimmings, in clearing for cultivation or cutting for cord wood. Heart wood is heaviest, and the weight diminishes on proceeding outwards to the surface or upwards to the top of the tree, but much less in old trees than in young growing ones. The sap wood of oak was found by Decandolle to fall short of the heart wood in weight, in the proportion of 6 to 7.

It has long been known that summer or early autumn is the season most favorable for the felling of timber, where the object is strength and durability. One reason why timber has not usually been cut at that season is, that most of those who fell trees are at that season occupied with their farming. The felling of trees is their winter employment. Nearly a quarter of a century ago, Timothy Pickering showed by experiments which he adduced, and by sound reasoning, that summer is better than winter for this purpose.* A writer in the *N. E. Farmer*,† who “has wrought more timber than most men, and for more uses than any he knows of,” says, he has found soft maple, cut in September, three times more lasting than ash or walnut cut in winter; that he has found the sap-wood of oak, cut in February and March, partly decayed in September, and the sap-wood of timber cut in May and June, decayed in a year, while the sap-wood of trees felled in September was perfectly bright and sound after two years; and that, from many observations he has made, he is satisfied that September is the best time for felling trees; and that if the tree be disbarked in June, and allowed to stand till September, the timber will be stronger and more durable. He has seen this proved with regard to elm, walnut (hickory,) and maple, which are considered the most perishable of the trees used for timber.

* See Vol. I., No. 3, for August, 1822, of the *N. E. Farmer*.

† Mr. Phineas Stevens, of Andover. *Ibid*, II., 370.

The same writer says,* that maple wood felled in June is liable to white rot, while that felled in September remains sound in the same situation; and that timber felled in September will not suffer from red rot or from powder-post. It seems reasonable, that a tree felled after the growth for the year is completed, and before the leaves have fallen, should have all its wood more mature, and should, at the same time, be prepared to be more easily and thoroughly seasoned, than if felled at any other season. The evaporation which takes place from the surface of living leaves is very great. If, therefore, the tree is felled while the leaves are fresh, their evaporative action, which continues for some time after the tree has fallen, will speedily dissipate all the unappropriated moisture which the trunk contains. If, on the contrary, the tree is felled after the leaves have been shed, all this moisture must remain to be slowly thrown off by the usual process of drying. If, again, the tree is felled earlier in the season, while full of sap, and when the newly formed wood has not yet been ripened by the action of the sun, there must be much of crude and acrid juices, not easily to be got rid of, and many particles of immature wood, at least in the outer layer, which will render the process of seasoning slower and more uncertain.

There is much evidence to be found in books and in the experience of ship-builders, that sticks of timber cut in the end of summer, and seasoned only by this speedy action of the leaves, often out-last winter-cut timber, which has had years of seasoning.

The naturalist, Buffon, after numerous experiments carefully made on a large scale, and continued through many years, ar-

* Ibid, VI., 394. He subjoins a table of the comparative value of timber felled at the two seasons of the year mentioned, which he thinks correct or nearly so :—

Oak,	cut in September,	10.0—in June,	4.5
Maple,	“ “ “	10.0—“	“ 2.4
Walnut, (Hickory),	“ “ “	10.0—“	“ 2.5
Elm,	“ “ “	10.0—“	“ 1.6
Ash,	“ “ “	10.0—“	“ 3.2

The four last, compared with white oak, provided all were felled in September will stand thus :—

Oak, 10.0—Maple, 5.5—Walnut, 6.2—Elm, 4.5—Ash, 5.6.

rived at the conclusion that nothing contributes so much to the solidity, strength and durability of timber, as completely stripping the trees of their bark, some years,—at least three, before they are to be felled. This should be done in the spring, when the bark is most easily separable. The tree continues to put forth leaves, and to expand and mature them for several successive seasons. But as no new wood can be formed, after the bark is removed, Buffon supposed that all the action of the leaves goes to add to the substance of the wood previously formed.* It is thus increased in density and weight; and he found that, universally, in the same kind of wood, strength is proportional to weight. By this process, the sap-wood was rendered as dry, hard and strong, as heart-wood, and in some instances even stronger. Timber managed in this way was found to be sometimes a fourth part stronger than that from trees in the same forest, and in all other respects precisely similar, treated in the usual way; that is, felled with the bark on, and dried under the open sky or under sheds.†

Such are some of the suggestions which I have desired to lay before my fellow-citizens of Massachusetts, for the improvement of their forests and the redemption of their waste lands. I have opened, very imperfectly, the great and important study of the history and management of forest trees. A tree is the most magnificent among the material works of God. The nature, the relations to soil, to climate and to exposure, the affinities, the properties and the uses to man and other animals, the dangers from enemies and diseases within and without, and the circumstances necessary to secure the health, growth and beauty of the trees of any one family, are subjects worthy of the deliberate and mature and long continued attention of any man, of whatever intelligence, and with whatever resources of science. The best disposition of trees in the landscape, the treatment of each according to its character and appearance at all seasons of

* This it probably does by appropriating the substance destined for new layers of wood, to lining and filling up the cells or tubes, of which woody fibre is composed.

† See Buffon, Tome II., edition de Richard, 1839. *Expériences sur les Végétaux*. Second Mémoire, p. 325, et suivantes.

the year, so as to foresee and to produce the desired effect at every point which the eye can reach, and the adaptation of the various kinds of trees to the houses, churches, bridges, and other structures already existing or to be erected, and also to water, and to roads,—things evidently possible and yet indefinitely difficult,—to do all this successfully is the province of an art, which well deserves to take its place in the front rank among the fine arts; whether we consider the science, taste and skill which it calls into play, the vastness of the scale on which it acts, or the grandeur of the end which it has in view.

But why should it be thought important to reclaim or render valuable the waste or worthless lands of Massachusetts? There are millions of acres of land in the Western States far richer than any in our State, which may be purchased for much less than it will cost to render barren land productive. Why not go thither and occupy the rich wild lands? For many reasons. This is our native land. It is painful to break the chain of affection which connects us with it. It is painful to separate members of the same family. Every improvement in agriculture, in the management of the forests, and in the use of the other natural resources of our State, makes it capable of sustaining a larger population, and thus enables more of our young men and young women to remain with us, rendering home dearer to those who would otherwise be left behind. The advantages of our life, in the long settled parts of the Bay State, are greater than can be expected, for more than a single generation to come, in the newly settled regions of the valley of the Mississippi or in any other new region. There are still higher reasons. We live in a climate and on a soil, best adapted, from their very severity and sterility, to bring out the energies of mind and body, and to form a race of hardy and resolute men. We have our churches, our schools, our libraries, our intelligent and virtuous neighbors,—dearer to us than any strangers can be. These we are not willing to leave. We wish that our children should grow up under the influence of the institutions which our forefathers have formed and left to us, and which we have been endeavoring to improve. Here we wish to live and to die; and when we die, we wish to be surrounded by those who are most dear to us.

WOODY PLANTS OF MASSACHUSETTS.

DISTRIBUTION INTO FAMILIES AND GENERA.

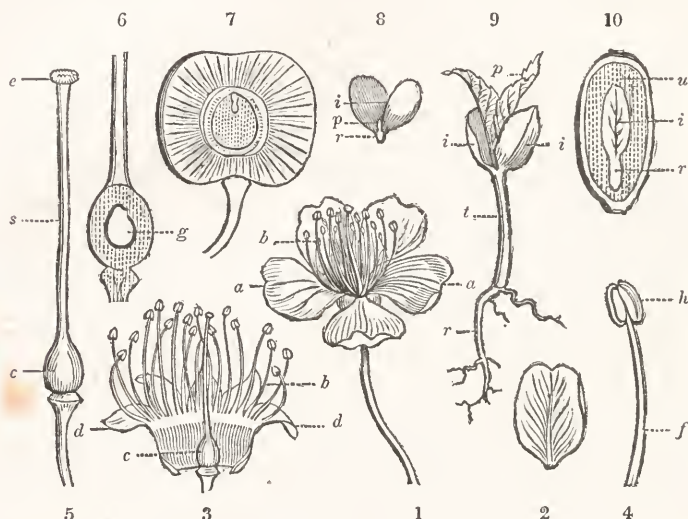
By means of the following analytical arrangement, the name and the place in the volume of any plant described, may be readily found. Each line is a question to be asked in regard to the plant whose description is sought. In case of an affirmative answer, the reader is referred by the Arabic number at the end of the line to the next question, which will be indicated by the same number at the beginning of a line. By pursuing this course, he will be finally referred to the place of the family and genus where the description is given. The Roman numbers refer to the family; the Arabic numbers which follow the Roman, refer to the genus under that family.

A few words of explanation are necessary to enable the reader to understand the arrangement of the table and the language used in reference to the flower and fruit.

A complete flower, the apple blossom, for example, is composed of, 1, an empalement or calyx of one or several leaves, called sepals of the calyx; 2, within these, of the flower leaves or petals of the corolla, usually colored of some other color than green; 3, of one or more stamens, thread-like, crowned by anthers which contain the fertilizing dust or pollen; and 4, in the centre of the flower, of one or more pistils, which are made up of the ovary or vessel containing the ovules or future seeds, surmounted by a stigma, which is often supported by a slender column called a style. A perfect flower is one which contains both stamens and pistils.

The matured ovary, with the seed or seeds which it contains, is called the fruit. A stone fruit with a fleshy covering, like the

cherry, is called a drupe. A samara is a nut with a winged margin, like the key of the maple or the winged seed of the elm. A capsule is a dry fruit formed of a compound ovary and opening of itself, as the seed-vessel of kalmia, or shedding its seed through chinks, as in the poppy. A pome is an apple, or a fruit resembling an apple.*



On most of the trees of temperate regions, the flowers are incomplete; wanting corolla or calyx or both, and having their

* EXPLANATION OF THE FIGURES.—1. A flower of the common cherry, *Cerasus vulgaris*, showing (*a, a*) the petals of the corolla, and (*b*) the stamens. 2. A separate petal. 3. A calyx laid open, showing (*d, d*) the divisions or sepals, (*b*) the stamens springing from the inner edge of the calyx, (*c*) the pistil occupying the centre of the flower, and consisting of an ovary, surmounted by a style crowned with a stigma. 4. A stamen, consisting of (*f*) the filament, and (*h*) the anther. 5. A pistil magnified, showing (*c*) the ovary, (*s*) the style, (*e*) the stigma. 6. An ovary much magnified and laid open, showing (*g*) the ovule suspended within. 7. Vertical section of the fruit or drupe of a cherry, showing the embryo in the centre with the radicle *superior*, or at the top. 8. The embryo taken out, with the cotyledons (*i*) partly expanded, the radicle (*r*), with the plumule (*p*) lying between the cotyledons. 9. An embryo germinating; (*i, i*) the cotyledons or seed-leaves with the plumule (*p*), now becoming leaves, between them; (*t*) the stem; and (*r*) the radicle, now become the root of the young plant. 10. A vertical section of a seed of the barberry, *Berberis vulgaris*, magnified, and showing the embryo with its leaf-like cotyledons (*i*) and tapering radicle (*r*), immersed in albumen (*u*).

place supplied by scales; and sometimes having the stamens and pistils in different flowers on the same, or even on different trees. They are often disposed in catkins or aments, which are the cylindrical, pendulous tassels which are seen, early in spring, on the birch and alder, for example; or clustered and horizontal near the ends of the branches of the pine. In the plane tree they are globular. In my arrangement, I shall begin with those plants whose flowers are simplest or least complete, consisting of stamens only or seed-vessels only, sustained and protected by one or two scales, and usually disposed in catkins; and proceed, in order, to those which have a calyx, but no corolla; those which have calyx and corolla; first of one petal; and lastly to those with a corolla of many petals with many stamens and pistils,—whose flowers are most complete.

An example will show the way in which the table may be used.

Suppose that a person has found a tree, with rough, simple, alternate leaves, flowers of two kinds, some with 5 stamens and no style, others with 5 stamens and 2 styles, with a calyx but no corolla, and a fleshy, berry-like fruit with a stone containing a single seed. He wishes to ascertain what the tree is. He begins with the first question, and, as the flowers are not in catkins, is referred to question 9. By that, as the leaves are alternate, he is referred to 20; thence, as the stamens are fewer than 10, to 21; thence, as the flowers are regular, to 22; as the flowers have not a corolla, but only a calyx resembling a corolla, he is referred to 23, and thence to 24; they have 2 styles, and he is referred to 28; 5 stamens, to 55, and he learns that his tree belongs to the Elm Family. The answer to question 55 shows him that it is the Nettle Tree, and is described in the second section of the tenth family, which he will find indicated by X. 2. on the left of the title on page 307.

DIVISION INTO FAMILIES.

1. { Flowers in catkins. 2.
Flowers not in catkins. 9.
2. { Leaves needle-shaped or scale-like, mostly evergreen. 43. PINE FAMI-
LY. 1.
Leaves not needle-shaped or scale-like. 3.

3. { Sterile flowers only in catkins. 4.
Both sterile and fertile flowers in catkins. 5.
4. { Leaves simple ; nuts in a cup. 49. OAK FAMILY. II.
Leaves pinnate ; nuts not in a cup. 51. WALNUT FAMILY. IV.
5. { Seeds with a tuft of cotton ; fertile and sterile flowers on different plants.
54. WILLOW FAMILY. VIII.
Seeds without a tuft. 6.
6. { Leaves palmate ; both fertile and sterile flowers in globular catkins. PLANE
FAMILY. VII.
Leaves not palmate. 7.
7. { Fruit woody, or membranous or winged. 52. BIRCH FAMILY. V.
Fruit a dry berry or nut, not winged. 8.
Fruit a fleshy, compound berry. MULBERRY FAMILY. IX.
8. { Nut more or less covered or concealed. 50. HORNBEEAM FAMILY. III.
Nut naked. 53. WAX MYRTLE FAMILY. VI.
9. { Leaves opposite. 10.
Leaves alternate. 20.
Leaves wanting. CACTUS FAMILY. XXV.

PLANTS WITH OPPOSITE LEAVES.

10. { Flowers with a calyx, and a corolla of 1 petal, or with no corolla. 11.
Flowers with a calyx, distinct or obscure, and a corolla of many petals. 15.
11. { Corolla wanting. 12.
Corolla of 1 petal. 13.
12. { Leaves simple ; fruit a double samara or key. MAPLE FAMILY. XXXIII.
Leaves pinnate ; fruit a single samara or key. ASH FAMILY. XV. 2.
13. { Stamens 4 ; calyx and corolla 4-parted ; ovary 2- or 4-celled. 58. MAD-
DER FAMILY. XVII.
Stamens 4 or 5 ; calyx and corolla 5-parted ; ovary 3- or 5-celled. 14.
14. { Corolla tubular, often irregular ; style thread-like. 59. HONEYSUCKLE
FAMILY. XX.
Corolla wheel-shaped, regular ; style almost wanting. 61. ELDER FAM-
ILY. XIX.
15. { Stamens fewer than 10. 16.
Stamens more than 10 ; style one. 78. ROCK ROSE FAMILY. XXXVII.
16. { Stamens more numerous than the petals. 17.
Stamens as many as the petals. 18.
Stamens once, or several times, 3, stigmas 3. 78.
17. { Fruit a leathery, prickly capsule. HORSE CHESTNUT FAMILY. p. 479.
Fruit a double samara or key. MAPLE FAMILY. XXXIII.
18. { Stamens opposite the petals ; berry above the obsolete calyx. 76. VINE
FAMILY. XXX.
Stamens alternate with the petals. 19.
19. { Calyx beneath 2 or 3 inflated capsules. BLADDER NUT. XXXII. 1.
Calyx indistinct, surmounting a 2-celled drupe. CORNUS FAMILY. XXII.
Calyx evident ; flowers in terminal panicles ; berry fleshy. PRIM. XV. 1.

PLANTS WITH ALTERNATE LEAVES.

20. { Stamens 10, or a smaller number. 21.
 { Stamens more than 10. 40.
21. { Flowers irregular, butterfly-shaped; fruit in a pod. 75. BEAN FAM-
 ILY. XXIX.
 { Flowers regular or nearly so. 22.
22. { Flowers with one petal, petals united at base, or with no corolla. 23.
 { Flowers with a corolla of many petals. 30.
23. { Flowers with a calyx, but no corolla. 24.
 { Flowers with an evident calyx, and a corolla of one petal, or united
 petals. 35.
24. { With 1 style or stigma; leaves simple. 25.
 { With 2 styles or stigmas, divergent; leaves simple. 28.
 { Pistils several; leaves compound. PRICKLY ASH FAMILY. XXXV.
25. { Leaves with transparent dots; anthers opening by valves. 56. CINNAMON
 FAMILY. XII.
 { Leaves not dotted; anthers not opening by valves. 26.
26. { Fruit one-seeded. 27.
 { Fruit 3-or more-seeded; a drupe or berry. 29.
27. { Fruit crowned with a calyx. SANDAL-WOOD FAMILY. TUPELO. XI.
 { Fruit not crowned with a calyx. 28.
28. { Stamens 5; a tree. 55. ELM FAMILY. X. 8.
 { Stamens 8; a shrub. MEZEREUM FAMILY. LEATHER WOOD. XIII.
29. { Leaves broad and flat; stamens 4 or 5. 77. BUCKTHORN FAMILY.
 XXXI.
 { Leaves broad and flat; stamens 6; fertile and sterile flowers on different
 plants. SMILAX FAMILY. XLI.
 { Leaves crowded, heath-like. CROWBERRY FAMILY. XIV.
30. { Flowers with the calyx nearly obsolete. 31.
 { Flowers with an evident calyx. 32.
31. { Fruit a drupe, crowned with the calyx; stamens alternate with the pe-
 tals. CORNUS FAMILY. XXII.
 { Fruit a berry, above the calyx; stamens opposite the petals. 76. VINE
 FAMILY. XXX.
32. { Stamens as many as the distinct petals and alternate with them. 33.
 { Stamens as many as the distinct petals and opposite them. 38.
 { Stamens twice as many as the petals. 36.
 { Stamens once, or several times, 3. 37.
33. { Calyx adherent to the ovary and crowning the many-seeded berry. CUR-
 RANT FAMILY. XXIV.
 { Calyx half adherent; capsule bony, 2-seeded. WITCH HAZEL FAMILY.
 XXIII.
 { Calyx free from the ovary; fruit few-seeded. 34.
 { Calyx free; fruit many-seeded. 36.
34. { Stamens on a fleshy disk; capsule berry-like. STAFF-TREE. XXXII. 2.
 { Stamens from the base of the calyx, or corolla, or from the receptacle. 37.
35. { Anthers opening by pores. 36.
 { Anthers not opening by pores. 57 or 65.

36. { Calyx free from the ovary. 62. HEATH FAMILY. XX.
 { Calyx adherent to the ovary. Berries eatable. 71. WHORTLEBERRY FAMILY. XXI.
37. { Drupe berry-like, fleshy or pulpy, with 4—8 stones. 57. HOLLY FAMILY. XVI.
 { Drupe dry, 1-celled, 1-seeded. SUMACH FAMILY. XXXIV.
 { Capsule 3-celled, 1 or 2-seeded. 78.
38. { Stamens 4—5; anthers not opening by valves. 39.
 { Stamens 6; anthers opening by valves. Prickly shrubs. BARBERRY FAMILY. XXXVII.
39. { Tendril-bearing vines. Calyx obsolete. 76. THE VINE FAMILY. XXX.
 { Erect shrubs. Sepals united at base. 77. BUCK-THORN FAMILY. XXXI.
40. { Stamens springing from the calyx. 41.
 { Stamens springing from the receptacle or base of the flower. 42.
41. { Fruit neither a pome nor a drupe. 72. ROSE FAMILY. XXVI.
 { Fruit a pome; calyx persistent. 73. APPLE FAMILY. XXVII.
 { Fruit a drupe; calyx deciduous. 74. ALMOND FAMILY. XXVIII.
42. { Pistil and style one; flowers perfect, stamens in parcels. LINDEN FAMILY. XXXVI.
 { Pistil and style one, flowers perfect, stamens not in parcels. 78, ROCK ROSE FAMILY. XXXVII.
 { Pistils about 2; only one ripening, forming a lunate drupe; sterile and fertile flowers on distinct plants. MOONSEED FAMILY. XXXIX.
 { Pistils many, united in a kind of cone; flowers perfect. 79. MAGNOLIA FAMILY. XL.

DIVISION INTO GENERA.

43. { Leaves in bundles or tufts, in a sheath. 44.
 { Leaves solitary. 45.
44. { Leaves 2—5 in a sheath, evergreen. PINE. I. 1.
 { Leaves 15—60 in a sheath, deciduous. LARCH. I. 4.
45. { Leaves alternate. 46.
 { Leaves imbricate, opposite or in whorls. 48.
46. { Fruit fleshy. YEW. I. 8.
 { Fruit not fleshy. 47.
47. { Bark always rough. SPRUCE. I. 2.
 { Bark smooth on young trees. FIR. I. 3.
48. { Leaves imbricate; branches fan-like; cones ovate. ARBOR VITÆ. I. 5.
 { Leaves imbricate; cones angular, somewhat spherical. WHITE CEDAR. I. 6.
 { Leaves opposite, or in whorls; cones berry-like. RED CEDAR and JUNIPER. I. 7.
49. { Cup scaly or warty, not covering the acorn. OAK. II. 1.
 { Cup a prickly bur, covering the 3-cornered nut. BEECH. II. 2.
 { Cup a prickly bur, covering the roundish nut. CHESTNUT. II. 3.
 { Cup leathery, hairy, covering the nut. HAZEL. II. 4.
50. { Nut in the axil or angle of a leaf-like bract. HORNBEAM. III. 1.
 { Nut enveloped in a hairy, inflated sack. HOP HORNBEAM. III. .

51. { Husk not dividing naturally. WALNUT and BUTTERNUT. IV. 1.
Husk of the fruit dividing naturally. HICKORY. IV. 2.
52. { Bark of thin, tough, horizontal fibres ; aments simple ; scale of the fer-
tile catkins 3-flowered. BIRCH. V. 1.
Bark not of tough fibres ; aments on branched stalks ; scale of the fer-
tile catkins 2-flowered. ALDER. V. 2.
53. { Leaves lance-shaped, serrate. WAX MYRTLE and SWEET GALE. VI. 1.
Leaves sinuate-pinnatifid. SWEET FERN. VI. 2.
54. { Stamens 8—30, or more ; leaves 3-angled or roundish. POPLAR. VIII. 1.
Stamens 2—7 ; leaves mostly long, slender. WILLOW. VIII. 2.
55. { Flowers perfect ; fruit a samara. ELM. X. 1.
Flowers sterile, or perfect, on one or different trees ; fruit a drupe. NET-
TLE TREE. X. 2.
56. { Anthers 4-celled ; fruit-stalk fleshy ; leaves often 3-lobed. SASSAFRAS.
XII. 1.
Anthers 2-celled ; fruit-stalk not fleshy ; leaves entire. BENZOIN.
XII. 2.
57. { Leaves thorny, leathery, evergreen. HOLLY. XVI. 1.
Leaves unarmed ; petals 4—5, distinct ; stamens 4—5. NEMOPANTHUS.
XVI. 2.
Leaves unarmed ; petals united, mostly 6-parted ; stamens 4—6. WIN-
TER BERRY, PRINOS. XVI. 3.
58. { Flowers in globular heads. BUTTON BUSH. XVII. 1.
Flowers 2 on each double ovary ; berry of 2 united ovaries. PARTRIDGE
BERRY, MITCHELLA. XVII. 2.
59. { Stamens 4. Trailing, evergreen. TWIN FLOWER, LINNEA. XVIII. 1.
Stamens 5. 60.
60. { Stem not woody. Drupe 3-celled, 3-seeded. FEVERWORT. XVIII. 2.
Stem woody. Berry 2—3-celled, few-seeded ; flowers two-fold, or in
whorls. HONEYSUCKLE, LONICERA. XVIII. 3.
Stem woody. Berry 2-celled, many-seeded. BUSH HONEYSUCKLE, DI-
ERVILLA. XVIII. 4.
61. { Leaves pinnate. ELDER. XIX. 1.
Leaves simple. VIBURNUM. XIX. 2.
62. { Petals united. 63.
Petals distinct or nearly so. 70.
63. { Corolla somewhat funnel-shaped or bell-shaped. 64.
Corolla salver-shaped. 65.
Corolla ovoid. 66.
64. { Stamens 5 or 6. AZALEA. XX. 9.
Stamens 10. RHODODENDRON. XX. 9.
65. { Anthers resting in 10 cavities of the corolla. KALMIA. XX. 10.
Anthers free, calyx double. MAY FLOWER, EPIGEA. XX. 6.
66. { Fruit a berry, formed of the fleshy calyx. CHEQUER-BERRY. XX. 7.
Fruit a drupe, formed of the ovary, 5-seeded. BEAR-BERRY. XX. 8.
Fruit a 5-celled, 5-valved capsule. 67. ANDROMEDA TRIBE. XX. 1.
67. { Anthers ending in awns or bristles. 68.
Anthers not ending in awns. 69.

68. { Anthers 2-awned. *ANDROMEDA*. XX. 1.
 { Anther-cells each 2-awned. *ZENOBIA*. XX. 4.
69. { Calyx with 2 bracts at base. *CASSANDRA*. XX. 2.
 { Calyx without bracts at base. *LYONIA*. XX. 3.
70. { Capsule 3-celled, 3-valved, enclosed by the calyx. Leaves smooth.
CLETHRA. XX. 5.
 { Capsule 5-celled, 5-valved, opening at base. Leaves rusty-downy beneath. *LEDUM*. XX. 11.
 { Capsule 5-celled, 5-valved, opening at the summit; corolla irregular.
RHODORA. XX. 9.
71. { Corolla ovoid-bell-shaped. Berry sweetish, black or blue. *WHORTLEBERRY*. XXI. 1.
 { Corolla wheel-shaped, with reflexed segments. Berry acid, red. *CRANBERRY*. XXI. 2.
 { Corolla broad-bell-shaped. Berry pleasant, sub-acid, white. *CHIOGENES*. XXI. 3.
72. { Fruit 3—5 distinct, dry follicles; unarmed. *HARDHACK*, *SPIRÆA*. XXVI. 1.
 { Fruit compound, of little drupes aggregated on a juicy receptacle; prickly. *BRAMBLE*, *RUBUS*. XXVI. 2.
 { Fruit the enlarged calyx, containing the stony seeds; prickly. *ROSE*, *ROSA*. XXVI. 3.
73. { Petals roundish; branches thorny. *HAWTHORN*, *CRATEGUS*. XXVII. 1.
 { Petals roundish; branches unarmed. *PEAR*, *PYRUS*, *SORBUS*. XXVII. 2.
 { Petals oblong; pome with 3—5 double cells. *JUNE BERRY*, *AMELANCHIER*. XXVII. 3.
74. { Stone compressed; fruit covered with a bloom. *PLUM*. XXVIII. 1.
 { Stone round; fruit not covered with bloom. *CHERRY*. XXVIII. 2.
75. { Leaves pinnate; stamens united; flowers in pendent racemes; stipules thorny. *LOCUST TREE*. XXIX. 1.
 { Leaves simple; stamens distinct. *JUDAS TREE*. XXIX.
76. { Leaves 3—5 lobed. Berry 1-celled. *GRAPE VINE*. XXX. 1.
 { Leaves digitately 5-leaved. Berry 2-celled. *VIRGINIA CREEPER*. XXX. 2.
77. { Calyx free from the ovary; petals plain; flowers minute; fruit like a drupe, black. *BUCK THORN*. XXXI. 1.
 { Calyx adherent to the ovary at base; petals sack-like, arched; flowers in panicles; fruit a capsule. *JERSEY TEA*. XXXI. 2.
78. { Petals 5, yellow; calyx 5-leaved, 2 outer smaller; plant erect. *ROCK ROSE*, *HELIANTHEMUM*. XXXVII. 1.
 { Petals 3, brownish purple, sepals 3. *PINWEED*, *LECHEA*. XXXVII. 2.
 { Petals 5, yellow; calyx 3-parted, tubular, with 2 outer minute divisions; plant downy, tufted. *HUDSONIA*. XXXVII. 3.
79. { Seeds pendulous by a thread, at maturity; leaves oval. *MAGNOLIA*. XL. 1.
 { Seeds not pendulous; leaves truncate. *TULIP TREE*. XL. 2.

THE WOODY PLANTS OF MASSACHUSETTS.

FIRST GENERAL DIVISION.

DICOTYLEDONOUS PLANTS.

THIS division is far the largest and most important in the vegetable kingdom. To it belong nearly all the woody plants of temperate and cold regions. Dicotyledonous plants are distinguished by the structure of the wood, the structure and arrangement of the vessels and leaves, and especially by the structure of the seeds. The trunk in woody plants is composed of 1, a central pith or medulla, which does not extend into the root; 2, of a ligneous medullary sheath, enclosing the pith; 3, of wood arranged in circles or zones, the inner ones of which are called *heart-wood*, and the external, usually of a different color, *sap-wood*; and 4, of bark, consisting of the inner bark, which is somewhat woody, the outer bark, composed of a green layer and a corky layer, and the epidermis or skin. From the pith radiate on every side, horizontally, vessels called medullary rays, the silver grain of wood, which extend through the wood and bark. The wood is formed by the annual addition of a new zone or layer outside the older wood and between it and the bark. This new zone consists essentially of woody vessels extending from the leaves to the extremities of the roots, and of the silver grain or medullary rays which traverse it horizontally on their way to the bark. A new zone of bark is at the same time formed between the new wood and the previous bark. The former exterior coats of bark are forced to expand, to make room for the newly formed wood and bark; and, when expanded to their greatest capacity, the external layers yield, crack, and open, causing the rugged, ridged, and furrowed appearance common in bark on the trunk of old trees.

The leaves of dicotyledonous plants are usually jointed or articulated at base to the stem, or they are composed of several

jointed leaflets, and are netted and feather-veined, the ribs and veins branching and running into each other; while the leaves of monocotyledonous plants are without joints, and have parallel ribs and veins which do not thus intersect.

The essential part of the seed of a dicotyledonous plant, the embryo, is composed of two cotyledons united by a neck or collar to a radicle or future root. The cotyledons are the seed-leaves, which, after the germination of the seed in the earth, usually expand upon the surface, as is conspicuously the case with the beech and the bean. Between these seed-leaves or cotyledons rises the plumule, the ascending axis, the future stem of the plant. Below them shoots downward the radicle, the descending axis or root.

FIRST GENERAL DIVISION.

DICOTYLEDONOUS PLANTS.

CHAPTER I. PLANTS WITH NAKED SEEDS.

FAMILY I. THE PINE FAMILY.—CONIFERÆ.

THE pines, firs, junipers, cypresses, spruces, larches, hemlock, and yews, with some foreign trees, form a very distinct and strikingly natural group. The name *evergreen*, by which they are commonly known, is liable to the exception that one of the genera found in our climate, the larch, loses its leaves in winter. But it is so distinguishing a characteristic of the rest, that it is likely to be long retained. This family has claims to our particular attention, from the importance of its products in naval, and especially in civil and domestic architecture, in many of the other arts, and, in some instances, in medicine. Some of the species, in this country, are of more rapid growth, attain to a larger size, and rise to a loftier height than any other trees known. The white pine is much the tallest of our native trees. Some are still found in New England reaching nearly to 200 feet; and it is not many years since pines were standing in the eastern part of New York, which measured 240 feet. Lambert's Pine, on the Northwest coast, is found growing to the height of 230 feet,* and Douglas's Pine, in the same region, the loftiest tree known, has been said to exceed 300 feet.

* Mr. Douglas gives the following description of one:—"One specimen, which had been blown down by the wind,—and this was certainly not the largest which I saw,—was of the following dimensions. Its entire length was 215 feet; its circumference, three feet from the ground, was fifty-seven feet nine inches; and at one hundred and thirty-four feet from the ground, seventeen feet five inches." *Linnean Transactions*, 16, p. 500.

The resin of this pine is used by the natives of the Northwest Coast as sugar; and the seeds are eaten, or roasted pounded into cakes, as part of their winter store. *Lambert's Genus Pinus*, p. 58.

From the pines are obtained the best masts, and much of the most valuable ship timber; and in the building and finishing of houses, they are of almost indispensable utility. The bark of some of them, as the hemlock and larch, is of great value in tanning; and from others are obtained the various kinds of pitch, tar, turpentine, resins and balsams, so important in a commercial and economic point of view. Oil of turpentine, and Bordeaux and Strasburg turpentine, are obtained from different species of pine; Burgundy pitch from the resin of the Norway spruce; Venetian turpentine from the larch; Hungarian and Carpathian balsams from pines, and Canadian balsam from our native fir. Liquid storax and the aromatic sandarach are the products of oriental and African trees of the same family. Extracts of hemlock and spruce enter into the composition of spruce beer, as do juniper berries into that of gin, and to them it probably owes its valuable diuretic properties. The seeds of several of the larger pines are eatable.*

There is also another circumstance in their history, of great interest to a country so large portions of which are spread over with sterile siliceous sands. On these, which are almost barren

* Lindley's Nat. Sys., 2d edit. p. 315. The juice of the pine is called liquid resin or turpentine. Common turpentine is the resin of the Scotch fir, *Pinus sylvestris*, and is obtained by making incisions in the bark and wood. Yellow resin is obtained from this by boiling it down; and essential oil of turpentine, or spirits of turpentine, by distillation with water, the residuum from which operation is common resin, black resin or colophony. These substances are extensively used in medicine, by painters in paints and varnishes, and in various processes of the arts. Tar is obtained by slowly burning splintered pine, both trunk and root, without free access of air, and collecting the liquid in cavities beneath the burning pile. Pitch is common resin and tar melted together. Lamp-black is made by burning the impurities of tar and pitch and collecting the soot. The inner bark of the Scotch fir is, by the natives of some northern regions, collected in spring, dried and preserved, to be baked on coals, ground, and kneaded into bread. Hungarian balsam exudes from the branches of the Mugho pine, *P. pumilio*, and an essential oil, called Krumholz oil, is distilled therefrom. Carpathian balsam is distilled from the shoots of the Siberian stone pine, *P. Cembra*. Strasburg turpentine is the liquid resin of the silver fir, *P. picea*, collected from the vesicles in the bark; as is Canada balsam or balsam of Gilead, from those in the bark of our balsam fir, *P. balsamea*. Concrete resin exudes from the Norway spruce; Burgundy pitch is prepared, by boiling, from the resinous juice of the same tree, flowing from incisions in the bark.

of other products, several species of pines may be planted or are found growing naturally with an approach to luxuriance. They will even take root and flourish among the moving sands exposed to the sea-breezes, thereby fixing these sands, and redeeming to the use of man, tracts otherwise destined to perpetual sterility.

The root of the pines is generally woody and irregularly ramified, and remarkable for its toughness and durability.* It never descends to a great depth, but spreads horizontally, to no great distance, near the surface. It is short and small, in comparison to the size of the tree, in this respect resembling that of the palms. In consequence of this peculiarity, most of the pines are uprooted by high winds, while the deciduous trees are broken off near the ground. In the winter of 1839—'40, I had an opportunity of examining the roots of a very large number of various species of pine which had been uprooted by the violent gale of the previous November, and I found that, in every case, they spread to a very inconsiderable distance, just below the surface of the ground. In old trees, of several species, particularly the white pine, the swollen roots appear above the ground to some distance from the trunk. In no instance, except in the anomalous case of the Southern cypress,† are suckers thrown up from the root; and only in the pitch pine have shoots been observed to spring from the stump.

Most of the plants of this family are trees of an erect, straight, cylindrical trunk, often of great size and height. In some, as the hemlock, the yew and the ginkgo tree, the branches have no regular order, but in most, and especially in the firs and pines, they are disposed circularly, in imperfect whorls, around the

* L. C. Richard, *Commentatio Botanica de Coniferis et Cycadeis*, p. 89, et seq.

† There is a striking peculiarity in the roots of the *Cupressus disticha* (*Taxodium*) of our southern states. This tree grows naturally in low grounds subject to annual inundations, in which situation it rises sometimes to the height of 120 feet, with a diameter at base of 25, 30, or even 40 feet. The roots, which run horizontally at a short depth below the surface, throw up conical, rounded protuberances, sometimes 4 or 5 feet high, but usually much smaller, smooth without and hollow, looking not unlike mile-posts, and remaining always naked. These may be observed, on a small scale, about the base of the magnificent cypress in Bartram's garden near Philadelphia.

trunk. One of these whorls is formed each year, from the row of buds which encircle that of the leading shoot, thus furnishing an easy mode of ascertaining the age of young trees. Where they grow together in thick woods, as occurs every where in our primeval forests, the lower whorls of branches speedily decay, from the absence of light and air, leaving a smooth trunk, rising with a beautiful shaft and scarcely perceptible taper, without a branch, to the height of 60 or even 100 or more feet. In the same manner grow the spruces and firs, and so the white pines in Maine still grow. Most of these forests, of the larger trees, have disappeared from Massachusetts, though a few are still to be found. In the cedar swamps, the straight stems are often found so near together, that such swamps can with great difficulty be penetrated.

The disposition and direction of the branches present striking differences in the different species, giving them each a peculiarity of aspect by which they can easily be distinguished at a distance. The regular horizontal stages of the white pine, the round, tufted masses of the pitch pine, the fan-like branches of the arbor vitæ, the formal pyramid of the spruce, the graceful cone of the fir, the fantastic and irregular raggedness of the red cedar, the spiry grace of the white cedar, and the softness and delicate outline of the hemlock, must have struck every observer. When growing naturally in the forest, the branches are always small; but when a tree stands by itself, the branches often grow large, and are numerous and permanent; and when the leading shoot is destroyed, the upper branches, particularly in the white and pitch pines, attain a great size. The bark of these trees, while young, is thin, and in most cases smooth. In the pitch and red pines and in the spruce, it is always rough. On the fir, it remains always thin and comparatively smooth, and full of cavities or crypts containing the balsam. In most of the true pines, it becomes, on old trees, very thick, rugged and deeply cleft. In the hemlock, and larch, and in some of the pines, it is charged with tannin.

The wood is disposed in concentric circular layers. The fibres are parallel and not closely arranged, but have considerable strength and elasticity. The wood differs physiologically

from that of other trees, in being made up entirely of woody fibres, which are hollow tubes marked externally with rows of microscopic, circular disks. The resin is deposited in peculiar vessels which have received the name of *turpentine vessels*. From the great abundance of resin which it contains, the wood is very combustible and remarkable for its durability. In the wood of most of the pines the resin does not seem to be deposited, at least in great quantities, during the life of the part. Old trunks are often found consisting almost entirely of *heart-wood*, soft and of a reddish or yellowish color, almost free from resin throughout. Where a growing branch is broken off, the remaining portion becomes charged with resin, forming what is called a *pitch-knot*, extending sometimes to the heart. The same thing takes place, through the whole heart of a tree, when, full of juices, its life is suddenly destroyed; and it is commonly supposed that the heart-wood of the trunk of a pitch pine increases in weight after it has fallen to the ground.

The leaves of the pines are very various. Most of the species have persistent leaves, and naturally come under the denomination of evergreen; but some of them, as the larch and ginkgo tree, for example, lose their leaves at the approach of winter. In the yew and some others, they are scattered irregularly; in some, as the arbor vitæ, they are opposite; in others, as the juniper, they are in whorls; and in the true pines, they are in bundles or fascicles, contained in a sheath formed of an altered leaf. The bundles in the true pines, and the solitary leaves in several of the most nearly allied genera, are arranged in spiral lines, which, to the number of five, six, or more, run parallel to each other around the tree. The same arrangement is found in the scales of the cones. The bundles are considered by the botanist as extremely short, abortive branches, as is often obvious in the larch. If we examine a pine of the first or second season, which may be readily done in our pine forests, we find the leaves single. Afterwards, from the axil of the solitary leaves, bundles of leaves, or abortive branches make their appearance, and finally the leaves are protected at base by a sheath.

The shape of the leaves is singularly various. For the most

part they are linear, needle-like or awl-shaped and stiff, as in the true pines, in which they vary, in different species, from two or three to twelve and even eighteen inches in length, in bundles of from two to six in a bundle. In the firs and spruces they are shorter, and flat or prismatic; still more so in the juniper and the yew; and in the cedar and cypress they are reduced to little more than pointed scales.* All of this family may be considered as destitute of stipules; the apparent stipules sometimes seen on the shoots from the stump of the pitch pine, being in reality solitary leaves, with bundles of leaves springing from their axils.

The buds exhibit a great variety of structure. Often they are naked, as in the juniper and arbor vitæ, the apparent scales taking, as they expand, the form of true leaves. Sometimes, as in the several species of pine, they are covered by scales totally different from leaves. They are sometimes, as in the fir, enveloped by resin; sometimes free from it. They usually, as in the pines, proceed only from the extremity of the trunk or branches, and contain the annual addition to the stem, and the whorl of branches.

With very few exceptions, the pines are monœcious, the male and female flowers being in different parts of the same plant, both usually disposed in cones or catkins, but totally unlike in structure. The male flowers consist of one or more stamens usually attached, with or without a stalk, to a scale, which, however, is sometimes wanting. The catkins of the male flowers are far more numerous than the cones of the female flowers. The yellow pollen, which is very abundant, often falls in such quantities upon the branches and leaves below, and upon the neighboring plants, as to cover them; and being as light and fine as dust, it has been sometimes carried by the wind from a forest of pines and spread upon the ground at a distance. This affords a probable explanation of the stories which have been told,

* In some of the foreign genera, they are broader and lanceolate, as in *podocarpus*; whilst in a few, as the *agathis* and *ginkgo*, they expand into a resemblance to the leaves of other dicotyledonous vegetables. In the remote genera *callitris* and *ephedra*, they are so small, scale-like and distant, as to give the plant the appearance of being destitute of leaves.

and which have been regarded with superstition or incredulity, of showers of sulphur.*

The female flower has till recently been considered as a pistil enclosed by a calyx and accompanied by one or more scales. Robert Brown has satisfactorily shown that in all plants of this natural family, there is neither pistil nor stigma, but that what have been considered such, are merely the extremities of a tube leading to a naked ovule, which is fertilized by the direct contact of the pollen from the male flower. In several of the genera the female flowers are single, and terminal or axillary. In most others they are arranged in cones. They are extremely simple, consisting usually of two scales, one which hardens and enlarges and forms a part of the surface of the cone, and a thinner one within it.

The ovary, with the calyx scale to which it more or less adheres, becomes the fruit. These have a great variety of appearance, from the fleshy, berry-like fruit of the yew and juniper, to the winged scale of the pine; but, when carefully examined, in their earlier stages, they are seen to have a strong resemblance; the fruit of the yew being formed by an extraordinary development of the receptacle, which, in most of the other genera, experiences little change, in the true pines a portion only of calyx expanding into a membranous wing.

The cones of many of the pines require two or three years to come to perfection. That of *Pinus pinea*, the stone pine of Europe, with edible seeds, requires four. During the first season the cone attains one-third part of its size; in the second it reaches its full size but remains green; in the third the scales usually become dry, change color and open, and the winged seed escapes and is carried to a distance by the winds.

The seeds of many of the pines are large and eatable. Those of our forests are small, but they are eagerly eaten by such birds as have the means of separating them from their cones; such as the pine cross-bill; and they furnish a portion of the winter's

* Poiret, *Botanique, Dictionnaire Méthodique*, V., 331. Lambert, describing the common Scotch fir, says, "The pollen is sometimes in spring carried away by the wind in such quantities, as to alarm the ignorant with the notion of its raining brimstone."—*Genus Pinus*, p. 2.

store to the red squirrel and other small quadrupeds which do not hibernate. These seeds consist of farinaceous matter impregnated with resin and oil. They are thence very nutritious. In some instances they may be eaten without preparation, as is the case with those of the stone pine of the South of Europe, in several countries of which they form a not unimportant article of food, and those of the Araucarian pine* of South America. In other cases the acidity of the oil must be previously removed by roasting.

The tenacity of life of the seeds is remarkable. They will remain for many years unchanged in the ground, protected by the coolness and deep shade of the forest above them. But when the forest is removed and the warmth of the sun admitted, they immediately vegetate. When the first leaves make their appearance above the surface, some of them, as those of the true pine and of others of that section, exhibit several seed-leaves, showing that their seeds are apparently provided with several cotyledons. They thus form an exception to the nearly universal character of the division of plants to which they belong. Some physiologists consider the exception only apparent, and regard the cotyledons as two, very deeply lobed.

Insects on the Pines.—With the exception of the oaks, the pines furnish sustenance to a greater number of insects than any other family of trees. The several parts of the tree, the leaves, the bark, the shoots, and the trunk, have, each, their peculiar inhabitants and enemies, terms which in this case are synonymous.

The leaves of the pines feed the “curiously checkered caterpillar of the *Sphinx coniferarum* ;” those of the pitch pine, and, more especially, of the fir, are destroyed by swarms of the

* The Indians make use of the fruit of this tree, the *Araucaria imbricata*, as a very nourishing food. They eat it raw as well as boiled and roasted ; with it they form pastry, and distil from it a spirituous liquor. There are stated times to collect the fruit, which they preserve to make use of as required.—*Lambert's Genus Pinus*, p. 108.

The seeds of the Brazil pine, *Araucaria Braziliانا*, are sold as an article of food in the streets of Rio de Janeiro.—*Id.* 111.

false caterpillars of the *Lophyrus abietis*.—(*Harris's Report*, pp. 230, 375.)

Several species of weevil, of which two (the Pales weevil, *Curculio pales*, and the white pine weevil, *Rhynchænus strobi*,—*Report*, pp. 62—64), are particularly described by Dr. Harris, dwell, during their larva state, under the bark of the pitch pine, the white pine, and probably others, and often do immense injury by destroying the alburnum and the inner portion of the bark. Whole forests of pines are sometimes thus killed by these apparently insignificant creatures. In addition to this mode of assault, the weevil which receives its name from the white pine, does great mischief by piercing, with holes from the interior of the wood to the bark, the leading shoot of this tree, thus destroying the shoot and maiming and deforming the tree. These attacks would soon be fatal to the whole race of white pines and probably all the others of the genus, were it not for an ichneumon-fly which deposits its eggs in the larva of the weevils, and the effectual services of the woodpeckers, who spend their useful lives in destroying them. The terminal buds and leading shoots of the pines and firs, are often destroyed by turpentine moths, an entirely different enemy, associated with the leaf-rollers.—(*Tortrices*, ib. p. 350.)

A small brown cylindrical beetle, the boring hylurgus, (*Hylurgus terebrans*, ib. 72), deposits its eggs in the bark of the pitch and other pines, the soft inner layers of which the grubs devour, and, by preventing the formation of new wood and by loosening the bark, cause the trees to languish and decay. They are sometimes accompanied by the grub of a smaller bark-beetle, (the *Tomicus exesus*, ib. 74), which leads a similar life, with similar consequences. Another still smaller beetle of the same pernicious family and habits, (the *Tomicus pini* of Mr. Say, ib. 74,) has been found under the bark of the white and pitch pines and that of the larch. The red cedar has a very small bark-beetle, (*Hylurgus dentatus*, the toothed hylurgus, ib. 73). A still more conspicuous bark-loosener, the ribbed Rhagium, (*Rhagium lineatum*, ib. 93), which does a work hardly less fatal for that tree, is found, in the grub state, often in great numbers under the bark of the pitch pine.

But the most numerous, if not the most fatal of the enemies of the pines, are the various kinds of borers which infest the trunk, on the wood of which they subsist. Two species of *Urocerus*, or horn-tail, neither of them common, (the *albicornis* and *abdominalis*; ib. 391—2), are found on the pines. They bore long holes in the trunk. The grubs of the one-colored *Prionus*, (*Prionus unicolor*, ib. 80), a large beetle, are also found in the same trees. Several beetles of the genus *Callidium*, live, while in the grub state, in the trunk of pines and firs or in the timber of these trees. One of them, (*Callidium bajulus*, ib. 83), which is found in "fir, spruce and hemlock wood and lumber," is supposed to have been introduced from Europe. Of the *Buprestian* beetles, the larvæ of which are wood-borers and eaters, and several of which are particularly fond of pines, the largest is the Virginian (*Buprestis Virginica*, ib. 43), which commits great ravages by boring in the trunks of the various kinds of pine trees. A much smaller species, (*Buprestis fulvoguttata*, the tawny-spotted, ib. 45), has been taken from the trunk of the white pine. Young saplings and small limbs of the same species of tree, are inhabited by a beetle of nearly the same size with the last-mentioned, to which has been given by Professor Hentz, the name of Dr. Harris's *Buprestis*, (*Buprestis Harrisii*, ib. p. 45.)

The soil natural to most of the pines is a sand formed originally by the crumbling or disintegration of the granitic rocks. These, in the forms of gneiss, mica slate and granite, are the prevailing rocks of Massachusetts; large portions of which, moreover, are overspread by the diluvium of sand formed from them. A large part of the surface was, therefore, and in many places still is, covered with forests of pine. The different species are adapted to the opposite extremities of moisture and dryness. The pitch pine flourishes on arid and parched sands; the white cedar thrives in swamps which are inundated almost through the year; the white pine prefers a situation moderately dry, but is often found in swamps; the red cedar and larch are found on rocky hills nearly destitute of soil, and the spruce and hemlock grow naturally in places inclined to moisture.

The pines are most readily propagated by seed. In and near the pine forests, they are sown naturally by the opening of the cones when mature, and the dispersion of the winged seeds by the wind. As the seeds of most species are very light, they are often carried to a considerable distance, and their abundance is such, that a single tree is sufficient to furnish seed for many acres. A few pines scattered through a forest of deciduous trees, fill the ground with seed, in a series of years, so completely, that when the forest is cut down, it not unfrequently happens that a pine forest springs up in its place.

If the trees are to be propagated artificially, the seed must be deposited on or near the surface; it should not be buried beneath, or, in case this is absolutely necessary, as when they are sown in open fields, the covering should not exceed an eighth of an inch, and should be light and loose. A soil and surface formed by the decay of the leaves of deciduous trees, is best, as it is precisely that in which the seed naturally vegetates. There are now, in every part of Massachusetts, large tracts of land which are too sterile, or too rough and rocky, to be cultivated to advantage, which might be easily sown with the different species of pine adapted to the various soils. The pitch pine would cover the sands, the red cedar and larch the rocky hills, the white cedar the swamps, and the hemlock and spruce and white pine all the regions between. Such tracts are usually overrun with low bushes, amongst which the seeds might be cast, and which would afford protection to the young plants against the winds, and the heat of the sun.

All the pines require to be cultivated in large masses. They naturally grow thus, and although, when so growing, they seem to be extremely hardy, they do not thrive when solitary, but are parched by the sun, and stunted by the cold and wind. In masses, especially when large enough to cover several acres, they not only protect each other, but are the best possible nurses for the tender deciduous trees. For this purpose, they are extensively employed in all young plantations in England and France, where the cultivation of forest trees has received the greatest attention.

The cones, which are mature after one, two, or three seasons,

may be gathered in the winter, as the scales do not usually open, to allow the seeds to escape, until the spring. Most of them, when perfectly dry, open spontaneously, and allow the seeds to be shaken out. In others they must be released by exposure to the sun or by force, either by cutting open the cone with a sharp instrument, or by beating, or by crushing in a bark-mill. Two winged seeds are usually found above each scale.

The best time for sowing the seeds is early in spring, as soon as the frost is out of the ground. If sown in autumn, they are liable to be devoured by mice and squirrels. If a few trees are to be provided for ornament or shade, the seeds may be sown in a prepared seed-bed of pulverized earth, and loosely covered to the depth of one-eighth or at most one-fourth of an inch. The bed should be in a sheltered situation, and the surface should be protected from the action of the wind and sun by loose branches, straw, or leaves. The soil of the seed-bed should be loamy or sandy, and, as in the case of the seed-beds of most other trees, it should be rich; as the thrift of the future tree depends much upon the vigor of the first shoot. The practice in France is to sow them in somewhat rich bog earth, or a mixture of this with sand.* The seeds should be sown in rows for the convenience of keeping the plants free from weeds. They have been observed to come up in from thirty to fifty days, but, in some instances, do not make their appearance until the succeeding spring or even later.† After they have grown two years in the seed-bed, they may be transplanted to a sheltered and fertile nursery, where they should remain at least one year before being removed to the spot where they are to stand.

Such is the course to be pursued when it is an object to have fine trees in the shortest time. But when poor, thin, rocky or sandy land is to be clothed with wood, and it is important to save the time and expense of the several transplantations, the seeds may be sown where the trees are intended to remain. They must be sown abundantly, as they are obnoxious to de-

* Le Bon Jardinier, p. 978.

† Loudon's Arboretum, 2132.

struction by various enemies. On a rocky surface, they may be cast into the crevices of the rocks, or beneath the thin soil which covers them. On an open plain, they require protection, which may be found in various low bushes, such as sweet fern; or if sown on a waste, sterile land, they must be sown with the seeds of some quick-growing shrub, or tall grass, which shall protect them for two or three years. For the first two or three years, these plants are of slow growth; but after the fifth they grow very rapidly; and continue, in favorable situations, to make one or two feet annually, until they have reached twenty or thirty feet, and, in the case of the taller species, a much greater height. The root, in most species, penetrates at once, in the first or second year, to the depth of one or two feet, but never to a much greater depth.

The evergreens are transplanted with less facility and success than most deciduous trees. Those intended for transplantation are, therefore, in the English nurseries, usually kept in pots, whereby they are prevented from throwing down a long root. All the pines are, however, successfully transplanted, if sufficient care be taken not to injure the roots nor heads, and to have a pit sufficiently large for all the roots to be fully spread, and *not to set them too deep*. The most difficult are the white and pitch pines. To ensure success, these should be transplanted in winter; the pits having been formed and the plant to be moved having been surrounded by a circular trench in the previous autumn. In this way, the whole of the roots, with the frozen earth adhering, may be removed in a single ball, and set at once in the pit, and surrounded by loose earth kept ready for the purpose.

The evergreens have been divided * into three sections:—

1. Those whose fruit is a true cone, with numerous imbricate scales, like the fir and pine;
2. Those with a globular, compound fruit, like the cypress and arbor vitæ;
3. Those with a solitary fruit, like the yew.

* By L. C. Richard. Annales du Museum, XVI, 296.

SECTION FIRST.

THE PINE AND FIR TRIBE. *ABIETINÆ*. RICHARD.

Of this section there are found growing in Massachusetts, 1. The White Pine; 2. The Red or Norway Pine; 3. The Pitch Pine; 4. The Hemlock Spruce; 5. The Black or Double Spruce; 6. The White or Single Spruce; 7. The Balsam Fir; 8. The Double Balsam Fir or Fraser's Fir; and 9. The American Larch or Hæmatack.

I. 1. THE PINE. *Pinus*. L.

The true pines are characterized by having their leaves in a sheath, 2, 3, or 5 together; and by the large size and hardness of the cones. Forty-two species are described by Loudon as having been introduced into England. They are all evergreen, generally of large size, and eminently useful and ornamental. Twenty-four* are natives of North America; of which three are found in Massachusetts; distinguished by the number of leaves in a sheath; these are either 5, on the White Pine; 3, on the Pitch Pine; or 2, on the Red Pine.

I. 1. Sp. 1. THE WHITE PINE. *Pinus Strobus*. L.

Figured in Lambert's *Pinus*; Plate 32.

Michaux; *Sylva*, III, Plate 145.

Loudon; *Arboretum*, VIII, Plate 329.

This tree is easily distinguished by its leaves being in fives, by its very long cones composed of loosely arranged scales, and, when young, by the smoothness and delicate light green color of the bark. It is known throughout New England by the name of white pine, which is given it on account of the whiteness of the wood. In England, it is called the Weymouth Pine.

The white pine is the tallest and most stately tree of our forests. It rises in a single straight column, tapering gradually

* *Lambertiana*, *strobus*, *monticola*, *leiophylla*, *Montezumæ*, *radiata*, *tuberculata*, *muricata*, *Californiana*, *Llaveana*, *patula*, *teocote*, *australis*, *Coulteri*, *Sabiniana*, *ponderosa*, *serotina*, *rigida*, *tæda*, *resinosa*, *pungens*, *mitis*, *inops*, *Banksiana*.

often to the height of 100, and sometimes, in the western part of the State, to that of 130 or 140 feet. In the forest, they are found with a shaft of a hundred feet, of arrowy straightness, entirely free from limbs. Formerly they were seen much taller; for the largest and most valuable timber trees have long since been cut down. Dr. Dwight informs us,* that they were frequently 250 feet in height and six feet in diameter; and he mentions one in Lancaster, N. H., which measured 264 feet. Fifty years ago, several trees growing on rather dry land in Blandford, measured, after they were felled, more than thirteen rods and a half,—or 223 feet. Many large trees are still found on the Penobscot and its branches. In the summer of 1841, a mast was made on that river, which measured, after being hewn to an octagonal shape, 90 feet in length, 36 inches in diameter at the but, and 28 inches at the top. Many masts are annually hewn on that river, from 70 to 90 feet in length. There is so much grandeur in these magnificent columns, that it is surprising that so few have been left. There would be little danger of their being prostrated by the wind, if left standing when the forest is cut away about them, as their leafy branches usually stand out, far above the tops of the trees by which they are surrounded, and they are thus accustomed to bear the violence of the storms. A clump of old white pines stands in perfect security, near the church in Blandford, on one of the most exposed points of the Green Mountain range. It is not uncommon to see old pines standing, deformed by the loss of the leading shoot, a loss from which they never recover, unless it occurs when the tree is quite young. Rarely two or more leaders are seen going up together.†

The roots of the white pine, even in the old trees of 70 or 100 feet in height, rarely penetrate more than two or three feet, taper rapidly, and extend 12 or 15, not often 20 feet on every

* Travels. Vol. I, p. 36.

† An old pine in the depth of a forest is often interesting from the variety of vegetable life which it exhibits,—covered with lichens; dotted *Lecideas* and *Lecanoras* and *Verrucarias* closely investing the bark on the lower part of the trunk, star-like *Parmelias* spreading over them, green and purple mosses in the crannies, and tufts of *Sticta*, *Ramalina* and *Usnea* higher up.

side. In trees of not over 25 or 30 feet, the roots do not penetrate more than 15 or 18 inches. They are covered with a reddish or greyish, sulphur-colored bark, broken on the surface into irregular rectangular scales. The wand-like rootlets, which are few in number, are very pliant and tough. The roots in old trees swell and project above the surface, forming natural buttresses on every side, for the support of the trunk. The bark on trees less than fifteen inches in diameter is very smooth, of a reddish bottle-green, covered, in summer, with an ashy or pearly gloss. On old trunks, it is less rough than that of any other pine. It is cleft by superficial vertical clefts into long plates two or three inches wide, which become more rough on the older trees, but do not scale off. The branches are in whorls or regular stages of about five at each stage, tending slightly upwards when young, but in old trees horizontal. In the forests all but the upper branches decay and disappear, and these, stretching out over the tops of the other trees, are conspicuous, and help to distinguish the white pines as far as they can be seen. The smaller branches are marked with spiral lines of the cicatrices of the fallen leaves. A single large bud, encircled by about five smaller ones, terminates each branch. The leaves are in fives, of a soft bluish green, slender, and from three to five inches long, arranged spirally in long tufts at the ends of all the branches, and giving great beauty to the young trees.

On the extremity of the newly opened buds, on the ends of the uppermost branches, are found the fertile flowers in erect cones, which, in June, at the time of the maturity of the staminate cone, are 3-10ths of an inch long, and half as broad, on scaly footstalks, 7-10ths of an inch long. These cones are made up of small, broad, fleshy scales, imbricately arranged in spirals. Outside the base of each is a thin, membranous, ragged scale, and within, near the base, two oblique openings, marked by a slight projection. These lead to cavities containing the ovule or future seed. There are neither styles nor stigmas, and the naked ovule is supposed to be fecundated by the fertilizing pollen coming directly in contact with it. At the end of one season, the cones are two or three inches long, of a fresh green, reflexed, on stout footstalks. In the succeeding

autumn, they are mature, when they are from four to six inches long.

The male flowers are in brown cones, 3-8ths of an inch long by 1-8th broad, on short stalks, surrounded by scales, occupying, to the number of twenty or more, half an inch of the base of some of the new shoots on the extremities of the lower branches. The pollen is contained in numerous, anther-like double sacks, opening on each side from top to bottom.

The geographical range of the white pine is from the Saskatchewan, in about 54° north, to Georgia, where it is found only on the ridges of the Alleghany Mountains; and from Nova Scotia to the Rocky Mountains; and beyond, from the sources of the Columbia to Mount Hood. It occurs in every part of New England; growing in every variety of soil, but flourishing best in a deep, moist soil of loamy sand.

The white pines receive different names, according to their mode of growth and the appearance of the wood. When growing densely in deep and damp old forests, with only a few branches near the top, the slowly-grown wood is perfectly clear and soft, destitute of resin, and almost without sap-wood, and has a yellowish color, like the flesh of the pumpkin. It is then called pumpkin pine. Standing nearly by itself, or surrounded by deciduous trees, especially on the boundaries between high lands and swamps, it grows rapidly, is usually full of knots and resin, has much sap-wood, and thence receives the name of sapling pine. Bull sapling resembles the pumpkin pine in all respects save the color of the wood, which is a clear white. These names are little used, except in Maine, and by persons who import wood from that State.

The roots of the white pine are almost incorruptible. In clearing up new lands, where the trees have been felled or blown down, the stumps with the roots are often taken up and used to make a fence by setting the under surface of the roots, to form the outside, towards the road. Fences so made, exhibit, after a hundred years, few signs of decay.

The branches, taken from the tree when they are beginning to die, form somewhat durable stakes; while the trunks of small trees used in this way decay very rapidly.

The qualities of the wood are lightness, softness, and durability. Its specific gravity, according to Mr. Bull, is .418, being less than that of any tree except the Lombardy Poplar. It is wrought with perfect ease, cutting freely in every direction. When kept dry, or exposed to the air, above the influence of the ground, it lasts for a great number of years; and is not split or much shrunk or warped by the sun; but it is subject to rapid decay when placed near the ground. Its defect is its want of strength.

The uses of the wood of the white pine are most important and numerous. As it forms timber and boards of a greater size than any other soft-wooded tree, and is lighter and more free from knots, it is employed, in preference, for masts of ships, for the large beams, posts and covering of wooden buildings, and for the frame-work of houses, barns and bridges, as well as for clap-boards, and sometimes for shingles. The clearness, softness and beauty of this wood, recommend it for the panels and frames of doors, for wainscoting, for the frames of windows, for cornices and mouldings, and for all the uses of the joiner. As it receives paint perfectly, it is employed for floors which are to be painted. For such as are exposed to much wear, as those of kitchens and back entries and stairs, the woods of the pitch pine and southern pine are preferred, on account of their superior hardness.

Every thing made of white pine is usually painted. Doors, panels, and tables of this wood are sometimes only varnished, so as to exhibit the wood itself. In this state, it gradually takes a yellowish or light reddish color, and has considerable beauty. Stained and varnished, it is a beautiful material for wainscoting, window frames, and the other internal finishing of a house.

It is excellent for the carver in wood, and is used for the figure-heads of vessels; and, as it takes gilding well, it is preferred for the frames of looking-glasses and pictures. In all the ways in which it can be used as fuel, it is of little value, though it burns freely when dry, and is much used for kindling.

In consequence of these numerous uses, it is every year becoming more scarce. The exportation from the growth of this State has almost ceased, and from New Hampshire and the

southern parts of Maine it has much diminished, and the lumber has become of inferior quality. From the Penobscot and other great rivers in the northern parts of that State, the exportation is still immense; but the lumberers have to go every year to a greater distance from the great water-courses, and to ascend smaller streams and more remote lakes. The same thing is happening in New York; and the day is evidently not far distant, when the inhabitants of New England even, will have to depend on Canada for this wood, unless measures are taken to restore the pine forests on those millions of acres which are suitable for no other use, while they are admirably adapted to the production of various kinds of pine.

The white pine is a tree of rapid growth. Where it has been cultivated, in England and France, it has been found to increase in height at the rate of from fifteen inches to three feet, each year, for fifty or sixty years. A tree near Paris, thirty years planted, is eighty feet high, with a diameter of three feet. By observing the annual stages of limbs, it may be seen, that in many parts of this State, it grows in height three or four feet a year, and sometimes more. In Dalton, I measured an old white pine, which was more than 100 feet high, and found its circumference at the ground twelve feet eight inches, and at three feet, ten feet nine inches.

In 1809 or '10 a belt of pines and other trees was planted on two sides of the Botanic Garden in Cambridge, to protect it from the northwest winds. In the winter of 1841 and '2, when they had been growing thirty-one years, many of them were carefully measured by myself, with the assistance of the skilful and intelligent gardener, Mr. Carter. Ten of the white pines exhibited an average of twenty inches diameter at the ground, showing an annual growth of nearly two-thirds of an inch in diameter. The two largest measured five feet seven inches in circumference at the ground, and four feet eight inches at the height of three feet. The average diameter at three feet was sixteen inches and one-half, and at five feet, more than fifteen and one-half inches. Rev. J. L. Russell gives me an account of a white pine which grew in a rocky swamp in Hingham, which, at the age of thirty-two years, gave seven feet circumference

at the but, and a height from root to top of sixty-two feet six inches, having thus grown almost an inch in diameter and two feet in height annually.

I. 1. Sp. 2. THE PITCH PINE. *Pinus rigida*. L.

Figured in Lambert's *Pinus*, Plate 16.

Michaux ; *Sylva*, III, plate 143.

Loudon ; *Arboretum*, VIII, beautifully, plate 326.

This tree is distinguished by its leaves being in threes, by the rigidity and sharpness of the scales of its cones, by the roughness of its bark, and by the denseness of the brushes of its stiff, crowded leaves. It has not great beauty, but it produces an agreeable contrast, by the deep green of its foliage, with the lighter colors of the deciduous trees ; and there is an irregularity about it, which often gives a single tree a picturesque appearance when seen at a distance. It is free from the stiffness of most of the other pines, and a hill clothed with it is a desirable addition to a prospect.

The pitch pine is commonly forty or fifty feet high, and one or two feet in diameter at base. In the most favorable situations in which it occurs, which are sands mixed with loam, and plentifully supplied with moisture, it sometimes attains the height of seventy or eighty feet, and even more, with a diameter of nearly three feet. Such trees are now very rare. About the ponds in Plymouth, where these pines rise considerably above the uniform growth of oaks, they must be seventy feet high, and I found the average size of several of the largest to be five feet and seven inches in circumference, at three feet from the ground. In other parts of the lower counties, I have found the largest sometimes over six feet. In a single instance, the circumference was six feet seven inches.*

On the hills in the southwestern corner of the State, they are

* One which I measured in Lyman, York County, Maine, was eight feet six inches in circumference at the ground, seven feet six inches at three and one-half feet above, and, by the estimation of a friend who was experienced in trees, ninety feet high. Several measured in Chester, N. H., were over seven feet in girth at the ground, and one was seven feet at three feet from the surface, and eighty feet high.

still found growing to the height of one hundred feet; and men are living in Massachusetts and Maine, who remember that it was not uncommon to find them of more than a hundred feet in height and four or five feet in diameter.

Almost every where, however, the pitch pines form low woods, occupying, together with the little gray birch, tracts of sterile land where few other trees would thrive. The edges and openings among these trees are tenanted by the low, tender blueberry, whose abundant fruit invites, at the season of its maturity, immense flocks of wild pigeons. But at other seasons, nothing can be stiller and more solemn than these forests. The hermit thrush loves to sit in the top of a pine and charm the woods with his solitary sweet notes, and when he is silent, a person sitting on the fragrant decaying leaves or soft moss, at its foot, may listen to the wind singing in its branches. The "going of the wind" among the leaves of the pine, is a peculiar sound. One accustomed to the woods easily distinguishes it from every other sound; and it is not difficult to believe that a practised ear might distinguish every particular tree, without the aid of sight, by the noise of the wind in its foliage.

The root of the pitch pine penetrates almost at once to the depth of one or two feet, and hence the difficulty of transplanting the young trees. But the roots of those forty or sixty feet high, which have been prostrated by the wind, are seldom found more than two feet below the surface. The horizontal ones are short, and are covered with a rough bark which comes off in flakes.

The trunk in dense woods is erect; in more open situations, it is often tortuous or angled. In the former case, where the limbs have perished at an early stage of the tree's growth, and its increase has depended upon a few branches near the top, the trunk is entirely without branches to a great height, and the wood is clear, and soft, free from knots, and almost free from resin, and, from the slow growth, the bark is less rough than usual. Such trees are called yellow pines, and are supposed by lumber-men to be of a different species.

The bark of the trunk is excessively rough, deeply cleft, and very dark colored, whence the tree is sometimes called black

pine. The young branches seem to have no true bark, but to be covered by the decurrent foot of the shrivelled leaf, from which grows the sheath of the bundles of leaves. The surface of every part of the tree is thus more rough than that of any other tree of the forest. But it is less liable to be covered by lichens.*

The branches are in imperfect whorls of three or more. So many of the branches perish, that this circumstance is often not visible in a solitary tree, but, to one examining a large number, it is immediately obvious. They usually tend upwards irregularly at a considerable angle, forming large deep masses of foliage, and never, except in very old trees, have the horizontal growth common to most other pines. As the trees usually grow at some distance apart, on extremely poor soil, they are almost uniformly much branched, and the branches are irregular, and larger than in other trees of this family. The leaves are in threes, with a callous point, flattish, rounded on the external side and angled within, and from two to five or six inches long; arranged in spirals and forming a stiff brush at the ends of the branches. The buds, which are long and slender, are covered with resin; they are found only at the extremities, where a single large bud is encircled by three or more smaller ones.

The sterile flowers are in catkins, half an inch or more long, in a few spirals around the base of the recent shoot, where they take the place of bundles of leaves. The anthers have two cells, from which is discharged a great quantity of sulphur-colored pollen. The fertile flowers are in cones, which are either solitary or two or more together, near the extremity of the new shoot. At the period of flowering, in May or June, they are one-third of an inch long, on a stout footstalk covered with thin reddish scales. At this period both male and female flowers have great beauty. At the end of one season, the cones are not apparently changed in size. At the end of the second, they are sometimes fully, sometimes half grown. When mature, which is usually at the end of the second autumn, although sometimes not till the third, they are of a conical shape, from

* A few *Usneas* and large *Stictas*, and occasionally the more vigorous *Parmelias*, find place on the bark.

two to three inches long, and each scale terminated in a short, acute, stiff spine. Michaux observed that, on solitary stocks exposed to the winds, the cones are constantly found in groups of four, five or more, and that they then remain closed for several years.

The pitch pine is found from the Penobscot River in Maine to the mountains of Carolina. On its northern borders it attains a height of only twelve or fifteen feet; on its southern, it is a large tree. The wood of the pitch pine is hard and firm, and remarkable, except in the variety above-mentioned, for the quantity of resin it contains. This is much more abundant in the branches than in the trunk, whence the boards and other lumber of this wood are usually full of pitch knots. When a tree stands some time after its vigorous growth has ceased, the whole heart-wood, and even the whole wood, is filled with resin, and converted into what is called pitch wood. This is so incorruptible, that it is often dug up entire in old pine woods, where it has been exposed for scores of years to alternations of moisture and dryness. The proportion of sap-wood to heart-wood varies in different situations. In a tree of fifty years' growth, the exterior twenty-five circles may be sometimes found of sap-wood.

The pitch pine is of far more value than it has usually been considered. The variety called yellow pine* is an excellent substitute for white pine for any purpose to which the latter may be applied. In Plymouth County, vessels have been made, in many instances, for a considerable time past, almost entirely of pitch pine. For the upper floor, for the lower deck, and for the beams, the best oak only is superior. Its principal defect, as a material for ship-building, is the comparatively insecure hold it gives to spikes; making it necessary to substitute, at certain points, pieces of oak timber. It is an excellent material for floors, not yielding to the Southern pine in durability and surpassing it in beauty. For water-wheels, it is preferred on account of its durability when exposed to alterna-

* This name is also applied to the Southern yellow pine, *Pinus australis*, and sometimes to the Norway or red pine, *Pinus resinosa*, with which there is no danger that any variety of pitch pine should be confounded by a botanist.

tions of wet and dry. For the same reason, it is selected for pumps, particularly ships' pumps, and also for aqueduct pipes, for which purposes pieces are chosen with little heart-wood. It is also an excellent material for the sills of houses and barns, and for the sleepers of rail-roads and the stringers of bridges, and for the frame of mills, and other structures in damp situations. It has also been made into staves for nail-casks. It is preferred to any other wood in the Northern States as fuel for steam-engines, and vast quantities of it are also consumed for the supply of families. Formerly, tar and lampblack were obtained from it. Now, from its increased value and scarcity, this use is rarely made of it.

As the pitch pine grows commonly on the most barren sands, its growth is not rapid. On sandy plains, too poor for profitable cultivation, and where only a single scanty crop of winter rye could be raised, far too small to repay the labor employed in its cultivation, I have observed the pitch pines gradually encroaching on the deserted fields, and making an average of twelve or fifteen feet in height in ten years. From the examination of hundreds of trees which have been felled and split, on the same kind of land, and which were generally sixty or seventy years old, it appeared, that for the first sixteen to twenty-five years, the trees had increased in diameter at the rate of from two-ninths to two-fifths of an inch a year. After the twenty-fifth, the circles of growth were uniformly narrower, there being rarely so few as ten to an inch, and often twelve or thirteen. It would thus appear, that on the very poorest land, this tree, when self-planted, increases at the rate of an inch in diameter in three or four years, for the first twenty-five years, and after that at the rate of one in five or six. In between fifty and sixty years, then, worthless barren sands may be covered with pines of a foot in diameter and forty or fifty feet high.

My friend, the Rev. J. L. Russell, lately of Chelmsford, has given me some very valuable facts upon this point. He says, in a letter dated December, 1839, "Twenty years ago, in sowing a sandy plain with rye, it was necessary to tear up a great many young pitch pines. This was near the middle of May. The young trees, averaging three feet in height, were thrown

into a cart and carried to an abandoned tract of ground, completely inundated with drift sand, and capable of producing merely the most useless weeds. With great haste the trees were planted in this desert, amid the merriment and derision of all who witnessed what was considered so fruitless an undertaking. But the experiment was perfectly successful, and in four straight lines stand at this moment ninety-seven pines, of which number one, and the finest, is a white pine, all the rest being pitch pines. They have attained the height of twenty or more feet, and the measures of the circumference of several are appended, as follows:—the white pine, two feet two inches; pitch pine, two feet four inches; two feet six inches; two feet six and one-half inches; two feet nine inches; two feet ten inches. The average circumference may be estimated at one foot nine inches. Several young trees are springing up beneath this little artificial forest, and the original plantation, beginning to produce seed, will soon cause a perceptible difference in the nature of the plain.”

These plants were probably four or five years old when transplanted. We thus find them of a diameter of from seven to ten or eleven inches, or an average of seven for all, in about twenty-five years. Mr. Russell recommends “to transplant when the new shoot or growth is about half an inch in length.”

Young trees in every stage of growth may be found along the borders of pine woods, particularly on the edges of ponds and the sandy banks of streams. In the first year, they rarely exceed three or four inches in height; in the second, they somewhat more than double their growth, but still look very slender and delicate; in the third year, they begin to assume some appearance of vigor, and often reach the height of eighteen inches or two feet. For the first two or three years the leaves are single; afterwards they appear in bundles from the axil of the single leaves. After the third year, the growth in favorable situations is rapid, sometimes at the rate of two or three feet a year. The best age for transplanting is two or three years.

The pitch pine has the great advantage of not being injuriously, at least not fatally, affected by salt water. Michaux observed it growing where the ground was overflowed by the

spring tides; and in many parts of this State it is found nearer to the sea than any other pine. It is thus adapted, in every respect, to be planted on the extensive sands on Cape Cod, Nantucket, and in some other parts, which are now not only utterly barren and unproductive, but, by being blown about by the winds, are a serious inconvenience to the habitations of man, and threaten to overwhelm the cultivated spots in their vicinity. On the western coasts of the continent of Europe, particularly in Holland, and in Gascony in France, are similar and more extensive wastes of drifting sand, called *dunes* or downs, which, from time immemorial, had been barren. These were tossed about by the winds, like the waves of the sea, the whole aspect of the desert being sometimes changed by a storm, valleys taking the place of hills, and hills of valleys. Fields, villages and even forests, had been overwhelmed by it, and it threatened to extend itself continually inland. "To obviate this evil," says Decandolle,* from whom I borrow the account, "the Dutch had for a long time been in the habit of sowing these downs with beach grass, (*Arundo arenaria*, L.), that its long matting roots might fix the sand. But if this takes from the sand its power of injuring, it leaves it wholly useless. On seeing the downs of Holland, I was struck with this defect, and pointed out the advantages of planting trees there. I was not then aware that the engineer Bremon tier had, as early as 1789, made trial of this very expédient on the downs of Gascony. Its success has since been made public, and I have myself had the pleasure of witnessing it, which I did with unaffected admiration. The process of Bremon tier is remarkable for its simplicity. He sows, in the loosest and dryest sand, the seeds of broom, (*Genista scoparia*,) with those of the maritime pine,† (*Pinus maritima*); and covers the surface sown, with branches taken from the nearest pine forest. The object of the branches is to arrest the sand for a time, and keep it from blowing away. The plants of the broom spring up first, and by their rapid growth, serve to retain the sand in its place and to shelter the

* Physiologie Végétale, p. 1236, Vol. III.

† This is a variety of the cluster pine, (*Pinus pinaster*.)

young pines. These continue to grow for seven or eight years under the shelter of the broom, the leaves of which annually mingle with the soil and fertilize it. After this period, the pines over-top the broom and often kill it by their shade. At the age of ten or twelve years, they begin to thin the forest, to make tar, and to get branches for continuing the process of sowing. In about twenty years, they begin to cut down the trees to extract the resin. These forests, situated on the downs along the sea, protect, from the continual action of the west wind, the whole space situated behind them, and thus, at the same time that they themselves furnish an important product, they secure those of the rest of the country."

He ends the account by saying, that he has herborized for a whole day in the forests sown by Bremon tier on sand completely arid, and on which, before him, scarce a trace of vegetation could be seen.

By pursuing, on the waste sands in many parts of this State, the course which has been so successful in France, forests for fuel and tar and lampblack, and perhaps for ship timber, may be formed on land which is now not only utterly valueless but in many places inconvenient and dangerous. The plant to be selected to protect the young pine may be the sweet fern, (*Comptonia*), or perhaps the very broom which has been used in France, as its seed could be easily imported, and there can be no doubt that it would grow on this side of the Atlantic as well as on the other.

Another use to be made of the pitch pine, is one to which the Scotch pine, which it much resembles, is put in England, that of serving as nurse to tender deciduous trees.

There is a circumstance about the pitch pine which I have never observed in any other tree of this family, and believe to be peculiar. Its stump throws up sprouts the spring after the stem has been felled. These continue to flourish, with apparent vigor, for several years, but I have never seen them attain any considerable height. The fallen trunk itself throws out sprouts in the succeeding summer; and the bundles of leaves of both are remarkable for issuing from the axil of a single leaf, in the same manner as is observed in the young plant.

I. 1. Sp. 3. THE RED OR NORWAY PINE. *P. resinosa*. Aiton.

Figured in Lambert's Pinus, Plate 13.

Michaux ; Sylva, III, Plate 134.

The Red or Norway pine has an erect trunk, taller and more slender than that of the pitch pine, which it most nearly resembles. The bark, which is much less rough, is in rather broad scales of a reddish color. The long leaves are in twos, and the cones are free from the bristling, rigid, sharp points, which distinguish those of the pitch pine. It may also be distinguished at a distance by the greater size and length of the terminal brushes of leaves.

This tree is known in New England by the name of the Norway pine, although it is entirely different from the tree so called in Europe, which is a kind of spruce. On this account Michaux* proposes to call it the Red pine, which name, he says, is given it by the English settlers in Canada. According to the elder Michaux, it is found from 48° north, as far south as Wilkesbarre, in Pennsylvania. Mr. Douglas found it in north-west America, along with Lambert's pine. It is nowhere abundant in Massachusetts, but is found, as is usually the case elsewhere, in little detached clumps, in various parts of the State. A grove of about twenty trees, in the edge of Newton, on a cross road leading from Brookline to the Lower Falls, is the only instance in which it occurs in the immediate neighborhood of Boston. It is also found, as I am told by Rev. Mr. Russell, forming a small wood in the town of Chelmsford.

In Maine and New Hampshire, where it is often seen mingling with the forests of white or of pitch pine, it is remarkable for its tall trunk sometimes eighty feet in height, free from branches, and of nearly a uniform size for forty or fifty feet or more, and its smooth reddish bark.

The branches are in distinct whorls, more regular than those of the pitch pine, horizontal or inclining first downwards and curving slightly upwards towards the extremities. The branchlets are stout and covered with a thick false bark, formed of

* Sylva, III, 112.

the foot of the scales from which issue the bundles of leaves, running down along the stem.

The leaves are in twos, of a semi-cylindrical shape, six or eight inches long, enclosed at base in very long membranous sheaths, arranged in close spiral lines, and forming large conspicuous tufts or brushes at the end of the branchlets. These showy tufts, which are of a dark green, upon a stem of a handsome shape and of vigorous growth, render the young tree a beautiful object.

The sterile or male catkins are at the base, rarely near the end, of the recent shoots, usually on the lower limbs, occupying the place of the leaves for one or two inches, and, like them, rising from the axil of a membranaceous scale. Each cone is three-fourths of an inch long and one-fifth broad.

The fertile cones are single or two to four together, around the new bud, at the extremity of the smaller branches on all parts of the tree. At the end of a year, the cones are two inches or more long, egg-shaped, tapering, set with green scales with a brown tip. They become mature in the course of the second season, and may be gathered for seed in the succeeding fall or winter.

The Norway pine grows as rapidly as the pitch pine, and usually to a greater height, and with a clearer stem, so as to form somewhat longer timber. A few years ago, it was not uncommon to find pine trees of this kind in the southern part of Maine exceeding one hundred feet in height and four feet in diameter. The wood is strong and somewhat durable, and much like that of pitch pine; but it is freer from resin, and softer, having qualities intermediate between it and that of white pine. It was formerly employed, like that of the pitch pine, for the decks of vessels, and sometimes for pumps and for masts; but it is found to be so much inferior in durability, that its use is almost entirely discontinued.



There are several pines, natives of Europe, which might be introduced with advantage into this country. The most valuable of these is the Scotch pine, (*Pinus sylvestris*,) or Scotch fir, as it is usually called, the only one of the genus which grows naturally in the British Islands. It also grows throughout the north of Europe, and it is from this pine, that the masts and other most valuable timber of Norway and the shores of the Baltic are obtained. The English ship-builders esteem the wood as superior to that of any of the American pines. This tree grows with as great freedom and luxuriance here as any of our native trees. Several stocks are to be seen at the Botanic Garden in Cambridge, where they have kept pace with the white pine, the pitch pine, and the hemlock. The Scotch fir has a striking resemblance to the pitch pine. It is a more beautiful tree, and differs in having its leaves, like those of the Norway pine, in twos.

Another is the cluster pine, (*P. pinaster*,) a native of the south of Europe, much cultivated in England as an ornamental tree. It is a variety of this tree which has been employed so successfully in France to cover and fix and turn to advantage the tracts of moving and barren sands on the coast.

Several pines, natives of the western coast of this continent, would probably be propagated without difficulty and be found of value for their wood. Such are the heavy pine (*P. ponderosa*), from the Northwest Coast, remarkable for the great weight of its wood; Sabine's pine (*P. Sabiniana*), from the mountains of California; and particularly the gigantic pine (*P. Lambertiana*), from the northwest country, in latitude 43°. This is nearly allied to the white pine.

I. 2. THE SPRUCE. *Abies*. Jussien.

The hemlock and the spruce belong to a genus distinguished from the pines in their general appearance, and by the following particular differences: their leaves are solitary and very short; the male flowers are in solitary aments; the cones are pendulous, or dependent; the scales of the cones are thin at their edge; the fruit comes to maturity in a single year. They are evergreen, resinous trees, of an erect, pyramidal shape, natives of Europe, Asia and America.

Three species are found in Massachusetts:—

1. The Hemlock has small, pointed, pendulous, terminal cones, and thin, flat leaves;

2. The Black Spruce has dependent, egg-shaped cones, with scales waved and jagged at the edge;

3. The White Spruce has cones longer, also dependent, and spindle-shaped, with scales smooth and entire at the edge.

Both have four-angled, awl-shaped leaves.

I. 2. Sp. 1. THE HEMLOCK. *Abies Canadensis*. Michaux.

Figured in Lambert's Pinus; Plate 45.

Michaux; Sylva III, 149, and beautifully in

Loudon; VIII, Plate 335, *a*, *b*.

The hemlock spruce, or hemlock, as, throughout New England, it is almost universally called, is the most beautiful tree of the family. It is distinguished from all the other pines by the softness and delicacy of its tufted foliage; from the spruce by its slender tapering branchlets, and the smoothness of its limbs; and from the balsam fir by its small terminal cones, by the irregularity of its branches, and the gracefulness of its whole appearance.

The young trees, by their numerous irregular branches, clothed with foliage of a delicate green, form a rich mass of verdure; and when, in the beginning of summer, each twig is terminated with a tuft of yellowish-green recent leaves, surmounting the darker green of the former year, the effect, as an

object of beauty, is equalled by very few flowering shrubs, and far surpasses that produced by any other tree.

In the forest, it rises with a uniform shaft sixty or eighty feet, with its diameter but slightly diminished until near the top, when it tapers very rapidly and forms a head round and full of branches. Below, it is set with stiff, broken, dead limbs, projecting at right angles to the trunk. The rapid tapering of the extremity of the stem, may be noticed at every period of its growth, and forms a striking peculiarity in the appearance of the tree.

The trunk of the hemlock is covered with a reddish bark, somewhat roughened by long shallow furrows, when it is old, but less so than on many other trees. The branches and small twigs have a smooth, light gray bark. The branchlets are very small, light and slender, and are set irregularly on the horizontal sides of the small branches, forming with them a flat surface. This arrangement renders them singularly well adapted to the making of brooms, a use of the hemlock familiar to housewives in the country towns throughout New England. In the disposition of the limbs, there is no approach to the regular stages of whorls, characteristic of the other pines, but they are scattered without order along the trunk, and being rather small, and horizontal, with an easy sweep upward, render a hemlock of forty or fifty feet, which has stood alone, the most graceful of the evergreens. The leaves are very small and flat, entire or with a few minute teeth towards the end, green above, and shining with rows of silvery dots beneath. They are on very small, thread-like footstalks, arranged in spirals around the branch, but disposing themselves, by the bending of the footstalks, in two rows on the sides.

The sterile flowers are on small aments at or near the end of the smaller branches. Each ament has at its base a few membranaceous brown scales, and, at a little distance above them, an oblong head, one-tenth of an inch long, formed of from ten to twenty heart-shaped, hollow scales, beneath each of which are two cells full of the fertilizing dust.

The fertile aments are on the ends of the outer branchlets. They are egg-shaped, one-fourth of an inch long, and imbri-

cated with green, fleshy scales, within each of which are two raised points, making an opening downwards to a cavity containing the rudiments of the future seed. Without, is a small, jagged, thin scale.

The cones are elliptical and pointed, of a light brown color, three-quarters of an inch long, and three-eighths broad, set upon the extremities of the smallest branches, and pendent on a short footstalk larger than the branchlet, of which it is the end. They consist of about twenty-five to thirty-five entire scales, rounded at the edge, the central ones protecting each two small seeds, which are furnished with wings in size and shape not unlike those of a common fly. The cones are mature in the autumn, and shed their seeds then and during the winter.

The hemlock is said by Pursh to extend to the most northern regions in Canada, and was found by Mr. Menzies in North-west America; it is found in every part of this State, on almost every variety of soil. It flourishes in the ruins of granitic rocks, on the sides of hills exposed to the violence of the storms. As it bears pruning to almost any degree, without suffering injury, it is well suited to form screens for the protection of more tender trees and plants, or for concealing disagreeable objects. By being planted in double or triple rows, it may, in a few years, be made to assume the appearance of an impenetrable, evergreen wall,—really impenetrable to the wind and to domestic animals. A hedge of this kind, seven or eight feet high, on a bleak, barren plain exposed to the northwest winds, gave Dr. Greene of Mansfield a warm, sunny, sheltered spot for the cultivation of delicate annual plants. When I saw it, the annuals, several of which were rare exotics, were beautiful, but the hemlock screen was much more so.

The hemlock is at first of slow growth, and the delicate drooping plant looks, for two or three years, as if the sun or the wind would inevitably destroy it. Unprotected and single, it should never be exposed to their influence. In three or four years it lifts up its head, and at last grows, in favorable situations, with great rapidity. Several trees at the Botanic Garden, which, in 1841, had been thirty-one years planted, showed, on careful measurement, an average growth of fourteen inches

in diameter at the ground, that is, somewhat less than half an inch a year. The largest of these measured five feet and three inches, the smallest, two feet and nine inches in circumference.

The timber of the hemlock is wanting in strength, in consequence of having the circles of growth separated at intervals, or, to use the language of the dealers in timber, being "shaky." This defect Michaux* supposes to be produced by the winds, acting with great force upon a broad compact summit rising above the heads of the surrounding trees. Its firmness is great, and it is very durable when not exposed to the atmosphere, but as it has little resin, it ill bears the alternations of moisture and dryness. It is therefore employed, together with spruce, in every part of New England, as a substitute for white pine, where the latter has grown scarce, for the frames of all kinds of buildings which are to be covered, for the board covering of wooden houses which are to be clap-boarded, and particularly, on account of its hardness, for the threshing floors of barns. It is preferred to other woods for the material of lathes, and for any purpose where stiffness is wanted without the property of yielding, or elasticity. It is much used in the large Atlantic cities, as a substitute for stone in the pavement of streets, for which purpose it is sawn into hexagonal blocks of eight inches in thickness, and eight, ten, or eighteen inches in breadth.

For fuel, it has not great value, as it burns with a great crackling and snapping. It is, however, used in close stoves. Many cords of the bark are annually consumed as fuel. But the most important use to which this bark is applied, and for which it is imported from Maine is, as a substitute for oak bark in the preparation of leather. It contains a great quantity of tannin, combined with a coloring matter which gives a red color to the leather, apt to be communicated to articles kept long in contact with it. On which account, this bark is not commonly used for the best kinds of leather, by itself, but mixed with oak bark; and the compound is said to be superior to either alone.

* Sylva, III, 168.

Sp. 2. THE BLACK OR DOUBLE SPRUCE. *Abies nigra*. Michaux.

Figured in Lambert's Pinus ; Plate 37.

Michaux ; Sylva, III, Plate 147.

The two species of spruce, the black and the white, or, as they are more commonly called, the double and the single, are distinguished from the fir and the hemlock, in every stage of growth, by the roughness of the bark on their branches, produced by little ridges, running down from the base of each leaf, and by the disposition of the leaves, which are arranged in spirals equally on every side of the young shoots. The double is distinguished from the single spruce, by the darker color of the foliage, whence its name of black spruce, by the greater thickness, in proportion to the length, of the cones, and by the looseness of the scales, which are jagged or toothed on the edge.

The trunk of the double spruce is perfectly straight and regularly tapering from the ground to the top. The bark is smooth, covered with thin, narrow scales, which on old trunks become roundish. On the smaller branches and upper part of the trunk, these scales are downward continuations of the leaves, and often come off with them. They are grayish in the middle, edged with brown.

The branches are in whorls of four or more, but, except on small trees, the whorls are not very distinct, in consequence of the premature decay of two or more of the branches, and of the fact that between the whorls are occasionally scattered single limbs. When a tree stands by itself, in a sheltered situation favorable to its growth, the stages or whorls are regularly disposed, and, diminishing gradually in length from the ground to the top, form a conical head of strikingly regular and symmetrical proportions. To the unpractised eye, this mathematical exactness of shape is beautiful, and the spruce is a favorite tree and is often placed in the near vicinity of houses. But to one studious of variety and picturesque effect, the regular cone becomes stiff and monotonous, and the unvarying dark green of the foliage has a sombre and melancholy aspect.

The recent shoots are pretty large, covered with a light

brown surface. The leaves are dark green, two or three fifths of an inch long, and obtusely four-sided, with rows of minute silvery, resinous dots in the grooves, above and below; they end in an abrupt point, and are supported by a minute brown footstalk, which runs down along the bark of the stem. They are very closely arranged in spiral lines,* and continue on the tree until, by the growth of the branch, they are one-fourth or one-half an inch asunder, their footstalks dividing the surface into irregular, lozenge-shaped spaces, gradually roughening, until, when the stem or branch is a few inches in diameter, it is covered with small, loose, thin scales.

The male flowers are in catkins, situated at the base or towards the end of the branchlets near the terminal buds. They are half an inch to an inch long, and are formed of a central axis or rachis, from which branch stamens on short footstalks, opening on two sides, and ending in a violet or purple, shield-like, lobed or nearly round disk.

The fertile flowers are in ovoid, erect catkins made up of scales which are of a pale purple, bordered with rose color. They open in May.

The mature cones are egg-shaped, pointing downwards, an inch or more in length, with obovate scales, not closely set, waved, notched or toothed, and sometimes divided on the edge. They are of a fine dark brown or purple, until mature, when they become pale brown. They ripen in November, but do not open until the following spring. The buds are short, leafy branches, surrounded by delicate, membranaceous scales.

The roots penetrate just below the surface and then run horizontally in curved lines to eight or ten feet distance. They are covered with a dark red bark, which is scaly on the smaller roots.

There is a superior variety of the double spruce with red wood, often considered a distinct species, and called red spruce. The color is doubtless owing to some peculiarity produced by soil or exposure, as was confidently stated by Michaux.

* These are eight, if counted one way, and eleven, if counted another; the leaves and scales of all the pines being so disposed as to form spirals in two directions.

The tree improves in size, height and vigor, with the latitude, for some degrees northward of this State. It is probably most perfect in the northern part of Maine or a little further north. It is found in Newfoundland, Nova Scotia, and throughout Canada, to latitude 65°, where it terminates with the paper birch.

Seven spruce trees of thirty-one years' growth, in the Botanic Garden, gave an average of thirty inches in circumference, or one-third of an inch annual growth in diameter.

It rarely grows to a large size. I measured a spruce in Becket, which had a circumference of five feet six inches near the ground, and diminished almost imperceptibly.

The valuable properties of the wood of double spruce, are strength, lightness, elasticity and durability. As combining these in a higher degree than any other wood applicable to the purpose, it is used for the smaller spars of ships, for all, indeed, except the masts and bowsprits, in preference to any other, except the white or single spruce, and in toughness it is superior to that. It is also sometimes used, in place of oak, or mingled with it, in the upper part of the hull, and is found to outlast the oak, and to possess the requisite tenacity. A builder in New Bedford informed me that a ship over thirty years old had had, during the whole time, a mizzen-mast of spruce, which, when taken out, exhibited no marks of decay. Knees, also, of great durability, are made of the lower part of the trunk and a principal root of the spruce. It is much used for making ladders, and extensively employed in building, being suitable for the smaller timbers in the frame, and for shingles. For these purposes, much spruce timber is brought to Boston from the lower part of Maine, particularly of the variety called red, and in pieces seventy or eighty feet long.

Great quantities of spruce beer are annually made from the recent shoots of the double spruce.*

* This beer is said to be made by boiling the fresh branches of spruce until the bark is loosened, mixing with the decoction roasted oats or barley and toasted bread or biscuits, sweetening with brown sugar or molasses, and causing the liquor to ferment, by means of yeast.

Sp. 3. THE SINGLE OR WHITE SPRUCE. *Abies alba*. Michaux.

Figured in Lambert's Pinus ; Plate 37.

Michaux ; Sylva, III, Plate 148.

This is a more slender and tapering tree of the swamps, marked by the light color of the bark and lighter green of the leaves. It rarely rises to the height of forty or fifty feet. It is perfectly straight, with numerous, somewhat irregularly scattered branches, forming a head of the same shape as that of the double spruce, but less broad, and with foliage of a less gloomy color, whence its name. The bark is of a light brown, somewhat roughened by scales an inch broad and of somewhat greater length.

The shoots are slender, of a light brown or yellowish color, the bark seeming to be made up, as in the other species, of small roundish ridges formed of the footstalks of the leaves extending downwards and ending at a leaf below. The leaves are of a light bluish green, in spirals rather closely set, and equally on all sides of the shoot. On the horizontal branchlets, the short footstalks of the leaves on the under side are so bent as to bring all the leaves to the upper half of the branch. The leaves usually fall off in two or three years, leaving a scaly surface bristling with the short persistent footstalks. These gradually disappear and the loose scales enlarge with the growth of the branch.

The root is remarkable for its toughness, and from it the Canadian Indians make the threads with which they sew together the birch-bark for their canoes.

The cones, which are pale green when young, and afterwards pale brown, vary in size extremely. As they grow here, they are from three-quarters of an inch to one and one-half inches long, nearly cylindrical in shape, or somewhat tapering, with rounded ends. In Canada, they are often three inches long. The scales are close set and perfectly smooth and entire on their edge.

The single spruce is thought to possess the excellent properties of the other species in an equal degree, and is preferred,

when it can be had, for the lighter spars of vessels, on account of the smoothness and beauty with which it works. It is found farther north than any other tree of America, and in latitude $67\frac{1}{2}^{\circ}$ attains the height of twenty feet or more.*

This tree has considerable rapidity of growth. Seven trees in the Botanic Garden, Cambridge, which had been planted thirty-one or thirty-two years, measured, one, two feet ten inches; one, two feet nine inches; three, two feet five inches each; one, two feet four inches; and one, two feet three inches; giving, on an average, a diameter of ten inches in thirty-one years, or a growth of somewhat less than one-third of an inch annually.

I. 3. THE FIR. *Picea*. Link.

The firs are lofty trees, social inhabitants of the colder regions of both hemispheres, and often forming vast woods. They are remarkable for the regularity and symmetry of their pyramidal heads. The leaves are solitary, needle-shaped, rigid, semper-virent, supposed by botanists to be formed of two, grown together. They are distinguished from the other pines by the smoothness of their bark, in which are formed cavities or crypts containing their peculiar balsam, by the silvery whiteness of the under surface of the seemingly two-rowed leaves, and by their long erect cones, formed of woody, deciduous scales, with a smooth, thin edge.

Sp. 1. THE BALSAM FIR. *Picea balsamifera*. Michaux.

Figured in Lambert's Pinus; Plate 41.

Michaux; Sylva, III, Plate 150.

Loudon; Arboretum, VIII, Plate 334.

This beautiful evergreen resembles the spruce in its regular pyramidal form. It differs from it in its bark, which is smooth when young, and continues so until the tree has attained considerable age; in its leaves, which are nearly flat, and of a beautiful silvery color beneath, and in having large, upright cones.

* Hooker's Fl. Bor. Am. II, 163.

It has a strong resemblance to the silver fir of Europe, a much loftier and nobler tree. The American tree is known by the name of fir balsam, or balsam fir, or simply, fir.

The root of the balsam fir, like that of the other pines, penetrates to a small depth, in young trees, not more than a foot; and extends horizontally to the distance of five or six, rarely ten feet, covered with a bright red or crimson bark, which separates in thin scales. The trunk is perfectly even and straight, and tapers regularly and rapidly to the top. It is a thrifty grower, and the young shoots are stout and large, and covered with a green bark striate with gray. They are close set with leaves in regular spirals, which continue many years, becoming more and more remote by the growth of the stem, and, when they fall, leaving a large, oval, horizontal scar of great permanence. The bark becomes, from year to year, of a deeper green, and remains smooth, swollen at intervals with the vesicles produced by the crypts containing the balsam, and in the larger stocks, on its native mountains, blotched with membranaceous lichens.

The branches, which in young trees incline upward, and on older ones become nearly horizontal, with a slight upward sweep, are in whorls of about five, often with the regularity of the branches of a chandelier, with occasionally scattered solitary limbs between. The leaves are sessile, from one-fourth of an inch to an inch in length, smooth, narrow, pointed, green with faint white lines above, with a silvery blue tinge beneath, produced by many lines of minute, shining, resinous dots. Arranged in spirals, they spread equally on every side of the stem or branch, but when the latter is horizontal, they so bend upwards from the lower side as to seem to form but two rows, or to be crowded on the upper side.

The buds, round and small, are enveloped in resin; those on the ends of the principal and larger shoots, are surrounded by about five smaller ones. Those on the lateral shoots are single or two or three together; and solitary buds are scattered irregularly at various points.

The stamens are in oblong heads or aments, one-fourth of an inch long, rather densely crowded on the lower side, near the

extremity of the branches. Each ament is on a short footstalk, which rises from a cup-like, irregular scale, in the axil of a leaf.

The cones are erect, near the ends of the upper branches, from two to four inches long, and an inch or more thick, nearly cylindrical or a little tapering, with the ends rounded, and set on very short, stout footstalks. They are made up of broad, round, bluish, purple scales, outside each of which is a scale resembling a transformed, winged leaf, and within are two seeds with short, broad, purple wings. They stand in great numbers on the uppermost branches, and, by their soft purple color, produce a fine effect.

The balsam is gathered, in small quantities, by puncturing the tubercles in the bark and receiving it in a cup, or shell, or an iron spoon. The process is a slow one, and the turpentine, which, under the name of *balsam of Gilead*, or *Canada balsam*, is reputed to have great virtues in pulmonary complaints, is sold at a high price in this country and in England. A valuable varnish for water-colors is prepared from it.

The wood of the fir is of little value, as it is deficient in hardness, strength and elasticity, and the tree does not often attain a large size. It is hardy, easily transplanted, and grows rapidly and with great vigor, and possesses in a high degree the most important qualities of the evergreens as an ornamental tree, a regular pyramidal shape, and rich, deep-green foliage. The large cones with which the upper branches are often loaded, give it additional beauty. Its defects are its stiffness, and the raggedness which it assumes in old age, which comes on early; as it is a short-lived tree.

Its chief recommendations are its hardiness and quickness of growth. It stands unprotected against the wind, when not blowing from the sea, better than any other tree, and grows on a bleak point where any other would be killed. Of several firs in the Botanic Garden, which had been planted in 1809 or '10, the largest measured, in 1841, after it had been thirty-one years planted, four feet two inches, at the ground, and three feet five inches, at three feet. One, planted in 1814, measured three feet ten inches at the ground, two feet six inches at three feet; and one, planted in 1819 or '20, measured three feet one

inch at the ground; giving an average growth of more than half an inch in diameter a year. The balsam fir is found, according to Dr. Richardson, in Canada and Nova Scotia to the Saskatchewan.

A mass of crowded branches, with minute, altered leaves, is sometimes found on the fir, similar to what will be hereafter spoken of as occurring on the red cedar.

The European silver fir, (the *abies pulcherrima* of Virgil), so similar and so superior to the balsam fir, and which sometimes attains to a height of one hundred or one hundred and fifty feet and even more, grows with great vigor in our gardens and nurseries, and wherever else it has been tried. It is an inhabitant of the mountains of the south of Europe. The Norway spruce seems equally well adapted to our soil and climate. It is the loftiest tree of Europe, and every way worthy of cultivation here. In Winship's nurseries, where it has been introduced a few years, it outstrips our native spruces. But still more remarkable and desirable trees of this genus, are found on the western side of the continent, within the limits of the territory of the United States. Such is the tree called Douglas's Spruce Fir, (*A. Douglassii*,) from the name of the person who introduced it into England. In its native forests, it varies from two to ten feet in diameter, and from one hundred to one hundred and eighty feet in height; and a stump is mentioned as still found on the Columbia River, which measures forty-eight feet in circumference at three feet from the ground, exclusive of its very thick bark.

Sp. 2. THE DOUBLE BALSAM FIR. *P. Fraseri*. Pursh.

Figured in Lambert's Pinus; Plate 42.

This tree has so strong a resemblance to the common fir, that it is difficult, except by the cones, to distinguish them. They have the same habit, the same kind of bark, and grow in similar situations. The double fir has its leaves usually much more crowded, whence probably its name. It is not often, however, by the common people, distinguished. The mature cone

presents a ready and certain distinction. It is of about half the length and two-thirds the thickness of that of the common fir, and the bracts or transformed leaves inside the scales of the cone, project and are bent back over the scales, and end in a somewhat long point, like the point of a leaf.

From the great richness and luxuriance of the foliage, the double balsam is a very beautiful tree, and its leaves diffuse a peculiarly agreeable resinous odor. It has been successfully transplanted in Vermont, and, in some instances, in this State, and is valuable as an ornamental tree.

Mr. Fraser discovered this tree on the high mountains of Carolina; and Pursh, who calls it Fraser's Pine, found it on the Broad Mountains in Pennsylvania. I have seen it nowhere in this State, except on the top of Saddleback Mountain. It is found on the Green Mountains, in Vermont, and on Mount Washington, in New Hampshire, and, mingled with the common fir, in the moist woods in Maine. It is a small tree, of the height of thirty feet, with a diameter of twenty inches.

I. 4. THE LARCH. *Larix*. Tournefort.

The larches are deciduous trees of cold and mountainous regions of both continents. They are distinguished from the other pines by their leaves, which grow many together, in bundles from the top of buds whose scales are as persistent as the leaves. The wood of the larches is remarkable for its hardness and durability.

I. 4. THE HACMATAK. *Larix Americana*. Michaux.

Two varieties figured in Lambert's *Pinus*; Plates 49, 50.

Also figured by Michaux; *Sylva*, III, Plate 153.

The tree by Loudon; *Arboretum*, VIII, Plates 346, 347.

The American larch, known very generally in New England by the aboriginal name of hacmatack, is not often, in this State, a tall tree. In deep forests it sometimes attains the elevation of seventy feet, but does not usually exceed half that height. It is distinguished from all others of the family by its crowded

tufts of deciduous leaves; from the European larch, by the smallness of its cones and the shortness of its leaves.

It has a straight, erect, rapidly tapering trunk, clothed with a bluish gray bark, rather rough, with small roundish scales. The branches are numerous, very irregular and horizontal, or nearly so. The recent shoots, which are very slender, have a grayish red bark, which on older branches becomes brown, and finally, as on the trunk, blue gray.

The leaves are an inch long, in circular tufts round a central bud, except on the growing shoots, where they are alternate. They are linear, flattened, obscurely four-sided, sessile and obtusely pointed at the end; of an agreeable light bluish green, and differ from those of all the other cone-bearing trees by the delicacy of their texture. Late in autumn they turn to a soft, leather-yellow color, and, in the first days of November, fall.

The sterile flowers are in solitary, erect catkins, which take the place of the fascicles of leaves towards the ends of the branches; they are nearly round, one-fourth of an inch long, and composed of rounded, yellow anthers closely arranged. The fertile flowers are in erect, solitary catkins, about the middle of the branches, half an inch long, and made up of a few floral leaves or scales. Around the base of the catkins are other scales resembling leaves half transformed, by a dilated wing on each side, into fertile scales. The true scales have a projecting point when in flower, but afterwards become nearly circular, slightly bent in at the edge, and have, within each, two seeds with a scaly wing; the scales and wings are of a pleasant crimson red. The flowering season is May.

The range of the hachmatack is from the mountains of Virginia to Hudson's Bay. At Point Lake, in latitude 65° , it attains, according to Dr. Richardson, to the height of only six to eight feet. It is found in cold swamps in most parts of this State; but attains its greatest perfection in a region considerably farther to the north.

The wood of the larch is very close-grained and compact, of a reddish or gray color, and remarkable for its weight, and its great strength and durability. In these respects, it is superior to all the other pines, and is surpassed only by the oak. Its dura-

bility is even superior to the oak itself, and in old vessels the timbers made of hacmatack have been found entirely sound, when those of white oak were completely decayed. On these accounts, it is preferred before all other woods, for knees, for beams, and for top timbers. The ship-builders make two varieties of the wood, the gray and the red, of which the latter is considered best. Its great hardness makes it valuable for steps in exposed situations; and its compactness gives it great power of resisting the action of fire, and renders it nearly incombustible, except when splintered. It would be better than any other wood in buildings intended to be fire-proof.

On account of the very valuable qualities of the wood, the hacmatack would deserve to be extensively cultivated, and there are thousands of acres of cold and swampy land, where it was found naturally, which are now unproductive, and which might be clothed with it. It has, however, been found to be far inferior in rapidity of growth to the European larch, which very nearly resembles it in appearance, and in the excellent qualities of its wood. This, therefore, should be preferred, as likely to produce in the same time, a larger quantity of timber from the same surface and at the same expense.

On favorable soils, the European larch is fit for every useful purpose in forty years' growth.* Its annual rate of increase in Scotland has been found to be from one to one and a half inches in circumference at six feet from the ground, on trunks from ten to fifty years of age. It has, moreover, the property of flourishing on surfaces almost without soil, thickly strown with fragments of rocks, on the high and bleak sides and tops of hills, where vegetation scarcely exists. It was in such situations as this, of a description which answers but too well to many waste spots in Massachusetts, that the most successful experiments were made, in Scotland, by the Dukes of Athol. These are so interesting in themselves, and so deserving of imitation, that a brief account of them cannot be considered unacceptable or out of place here.†

The estates of the Dukes of Athol are in the north of Scot-

* Loudon's Arboretum, IV, 2353, *et seq.*

† Highland Society's Transactions as quoted in Loudon's Arboretum, 2359, *et seq.*

land, in the latitude of nearly 57° north. Between 1740 and 1750, James, Duke of Athol, planted more than twelve hundred larch trees in various situations and elevations, for the purpose of trying a species of tree then new in Scotland. In 1759, he "planted seven hundred larches over a space of twenty-nine Scotch acres, intermixed with other kinds of forest trees, with the view of trying the value of the larch as a timber tree. This plantation extended up the face of a hill from two hundred to four hundred feet above the level of the sea. The rocky ground of which it was composed, was covered with loose and crumbling masses of mica slate, and was not worth above £3 a year altogether." Before he died, in 1764, he was satisfied of the superiority of the larch as timber, over the other firs, even in trees of only eighteen or nineteen years old. His successor, John, Duke of Athol, "first conceived the idea of planting larch by itself as a forest tree, and of planting the sides of the hills about Dunkeld." He planted three acres with larches alone, at an elevation of five or six hundred feet above the level of the sea, on soil not worth a shilling an acre. He also planted over four hundred acres on the sides of hills, before his death in 1774. His son, Duke John, continuing the execution of his father's plans, had planted, in 1783, two hundred and seventy-nine thousand trees. Observing the rapid growth and hardy nature of the larch, he determined to cover with it the steep acclivities of mountains of greater altitude than any that had yet been tried. He therefore enclosed a space of twenty-nine acres, "on the rugged summit of Craig-y-barns, and planted a strip entirely with larches, among the crevices and hollows of the rocks, where the least soil could be found. At this elevation, none of the larger kinds of natural plants grew, so that the grounds required no previous preparation of clearing." This plantation was formed in 1785 and 1786. Between that year and 1791, he planted six hundred and eighty acres with five hundred thousand larches, the greater part only sprinkled over the surface, on account of the difficulty of procuring a sufficient number of plants. Besides a plantation of seventy acres for the purpose of embellishment, he had, in 1799, extended his plantations of larches over an additional space of eight hundred

acres, six hundred of which were planted entirely, though thinly, with larch. These took eight hundred thousand plants.

“Observing with satisfaction and admiration the luxuriant growth of the larch in all situations, and its hardihood, even in the most exposed regions, the duke resolved on pushing entire larch plantations still farther, to the summit of the highest hills.” He therefore determined to cover with larch sixteen hundred Scotch acres, “situated from nine hundred to twelve hundred feet above the level of the sea. Its soil, presenting the most barren aspect, was strewed over thickly with fragments of rock, and vegetation of any kind scarcely existed upon it.” “To endeavor to grow ship-timber,” writes the duke, “among rocks and shivered fragments of schist, such as I have described, would have appeared to a stranger extreme folly, and money thrown away; but, in the year 1800, I had for more than twenty-five years so watched and admired the hardihood and the strong vegetative powers of the larch, in many situations as barren and as rugged as any part of this range, though not so elevated, as quite satisfied me that I ought, having so fair an opportunity, to seize it.”

These, with four hundred acres more, occupied from 1800 to 1815. “Having now no doubt whatever of the successful growth of the larch in very elevated situations, the duke still farther pursued his object of covering *all* his mountainous regions with that valuable wood. Accordingly, a space to the northward of the one last described, containing two thousand nine hundred and fifty-nine Scotch acres, was immediately enclosed, and planted entirely with larch. This tract, lying generally above the region of broom, furze, juniper, and long heath, required no artificial clearing. An improved mode of planting was employed here, that of using young plants only, two or three years’ seedlings, put into the ground by means of an instrument invented by the duke, instead of the common spade.” In 1824, the growth of the larch in this last tract, called “Loch Ordie Forest, having greatly exceeded the sanguine hopes and expectations of the duke, he determined on adding to it an extensive adjoining tract, consisting of two thousand two hundred and thirty-one Scotch acres, denominated Loch Hoishnie. The

preparations of fencing, clearing (where that was necessary), making roads, and procuring plants from different nurserymen, occupied the time till October, 1825, when the planting commenced, and was carried on in such good earnest, that the whole was finished by December, 1826."

"The planting of this forest appears to have terminated the labors of the duke in planting." He and his predecessors had planted more than fourteen millions of larch plants, occupying over ten thousand English acres. It has been estimated, that the whole forest on mountain ground, planted entirely with larch, about six thousand five hundred Scotch acres, will, in seventy-two years from the time of planting, be a forest of timber fit for building the largest ships. Before being cut down for this purpose, it will have been thinned to about four hundred trees to an acre. Supposing each tree to yield fifty cubic feet of timber, its value, at a shilling a foot, (one-half the present value), will give £1000 an acre, or in all, a sum of £6,500,000 sterling. Besides this, there will have been the value of the thinnings, and the increased value of the whole ground for pasturage.

This effect upon the land in improving it for pasturage is very important. If the larch trees are planted close, they will choke the bushes and natural grasses. This may be effected in ten or fifteen years. After this, gradual thinnings may be accompanied by the introduction of all the most valuable cultivated grasses, which, under the cover of the larches, will flourish "with the foliage possessing a softness and luxuriance not possessed in other situations."

There are large surfaces, particularly in Essex and Bristol counties, of bleak, rocky, barren hills, or wet plains, not so exposed as that spoken of above, but almost equally useless, which might doubtless be redeemed by a similar process. We have now to send to the southern states and to New York and Maine, for a great portion of our ship-timber. Of this the live oak and white oak alone are superior to larch, and for many purposes they are only equal to it. In seventy years, the ship-yards on Mystic River and on Buzzard's Bay, might be supplied with timber from the neighboring shores, if the land suit-

able for that purpose, and for little else, were immediately to be planted with larch. In half that space of time, the thinnings of the forest would furnish the smaller timber in abundance. It may safely be predicted, that if measures are not taken to restore or preserve our forests, if the same waste goes on, which has gone on for the last fifty years, in seventy years' timber of every kind will be as rare and as dear in New England as it now is in Scotland.

On the continent of Europe, the larch is put to a great variety of uses. It is considered the best of the woods, both for the carpenter and the joiner; casks are made of it, nearly incorruptible; water-pipes, shingles, vine-props. Its excellent properties for ship-building, as enumerated by Pontey, are its freedom from knots, its durability, its little liability to shrink; or to crack; its toughness; its beautiful color and its capability to receive polish; its incorruptibility, when exposed to alternations of moisture and dryness.

The soils suitable for the larch, according to Matthew,* are sound rock, with a covering of loam, particularly when the rock is jagged or cleft; gravel, not ferruginous, in which water does not stagnate, even though nearly bare of vegetable mould; firm, dry clays, and sound, brown loam; all very rough ground, particularly ravines. The most desirable situation is, where the roots will neither be drowned by stagnant water in winter, nor parched by drought in summer.†

The magnificent cedar of Lebanon, (*Cedrus Libana*,) resembles the larch more than it does any other of our pines; differing in having its leaves, which are arranged in the same manner, evergreen, and in the greater size of its cones and its broad, spreading top. It is successfully cultivated as an ornamental tree in every part of Great Britain and in France, and would doubtless succeed in New England.

* As quoted by Loudon, p. 2376.

† A very valuable account of every thing relating to the whole cultivation, management and uses of the larch, is found in Loudon's Arboretum, pp. 2353 to 2399.

SECTION SECOND.

THE CYPRESS TRIBE.

The plants which belong to this section have not their fruit in a true cone, but in a globular or irregular head, consisting of a small number of scales, sometimes united into a sort of berry. The section includes the Arbor Vitæ, the Juniper, the Red and the White Cedar, the Cypress, and the exotic genus *Callitris*. Most of the section are natives of warmer climates. Those which belong to New England are evergreen, but scarcely resinous. They may be propagated by layers or cuttings, but more readily by seeds, which generally lie in the ground a year. The young plants are to be treated like the pines.

I. 5. ARBOR VITÆ. CEDAR. *Thuya*. L.

The name of this genus is derived from a Greek word (*θυω*) signifying to sacrifice, it having been used, from the agreeable odor of the wood, in sacrificial offerings. The thuyas are narrow, pyramidal, evergreen trees or shrubs of Asia, Africa, and North America. The cones are ovoid, of a few scales, of which the two exterior are shortened and boat-shaped.

Sp. 1. THE AMERICAN ARBOR VITÆ. *Thuya occidentalis*. L.

Figured by Michaux ; *Sylva*, III, Plate 156.

The tree, flower and fruit, by Loudon ; *Arboretum*, VIII, Plate 302.

This is a rare inhabitant of Massachusetts. In favorable situations, it is sometimes, according to Michaux, a tree of forty or fifty feet in height, with a trunk ten feet in circumference. But usually it is not more than ten or fifteen inches in diameter at five feet from the ground. The trunk is rarely straight, and is often swollen in large ridges above the principal roots. "The bark is slightly furrowed, smooth to the touch, and very white when the tree stands exposed. The wood is reddish, somewhat odorous, very light, soft, and fine-grained. In the northern part of the United States and in Canada, it holds the first place for durability. From the shape of the

trunk it is difficult to procure sticks of considerable length and a uniform diameter; hence, in Maine, it is little employed for the frame of houses and still less for the covering. It is softer than white pine, and gives a weaker hold to nails, for which reason the Canadians always join with it some more solid wood.”* It is most commonly used for fences, in which the posts, set in clayey land, last thirty-five or forty years, and the rails last sixty. It is also used in Canada for the light frame of bark canoes. Its twigs are formed into brooms, which exhale an agreeable aromatic odor.

Michaux says that his father, in 1792, found the mission-house built by the Jesuits near lake Chicoutomé, in latitude 48°, of square beams of this wood, laid one upon another, without covering on either side, remaining perfectly sound after more than sixty years.

Dr. Richardson found this tree from Lake Huron to the Saskatchewan.

The smaller branches are of a yellowish brown color, regularly set with opposite, scale-like, adhering leaves, with the margins and point slightly projecting. The leaves are evergreen, arranged in four rows, in alternately opposite pairs, completely investing and seeming to make up the fan-like branchlets. They are scale-like, marked with a projecting gland below the point, each lower pair embracing and covering the base of the pair above. The branchlets which they cover are arranged in a single plane, as if they were parts of a large compound, flat, pinnate leaf. These planes are variously inclined to the horizon, often vertical, and form the striking peculiarity of this picturesque tree.

The male and female flowers are on different parts of the same plant. The male flowers are very minute, four or six in number, in alternately opposite pairs, forming, together, a small terminal ament, one-twelfth part of an inch long, on a very short footstalk. Each flower consists of a roundish shield-like scale, protecting two, three, or four anthers. The female flowers consist of six to twelve reddish, dark-pointed scales, on

* Sylva, III, 229.

the sides or ends of the branches. They slightly resemble transformed leaves, each holding in its bosom two bottle-like ovaries. The cones are of a light brown color, three-eighths of an inch long, consisting of from six to twelve loose, oblong, rounded scales, protecting each two seeds, which are edged by a narrow wing on each side.

The arbor vitæ is interesting from its association with the grand and beautiful objects, near which it is commonly seen growing wild; such as Goat's Island at Niagara, and the steep banks of West Canada Creek at Trenton Falls. It is found only in cool and moist situations, but may be cultivated in any ground not too dry. Its fantastic and singular shape recommends it to be planted for the embellishment of water-falls, and as a beautiful single tree.

I. 6. CEDAR OR CYPRESS. *Cupressus*. Tournefort.

The cypresses, for to this genus our white cedar belongs, are low, evergreen trees, natives of Europe, Asia, and North America, and remarkable for their spiry form, and the closeness of grain, and the durability of their wood. They have a roundish or polyedral cone, called a galbule, and small, imbricated, scale-like, four-rowed leaves. By the ancients, the cypress was considered an emblem of immortality; with the moderns, it is emblematical of sadness and mourning.

Dark tree! still sad, when others' grief is fled,
The only constant mourner of the dead.—*Byron*.

THE WHITE CEDAR. *Cupressus thyoides*. L.

Figured by Michaux; Sylva, III, Plate 152.

This is always a graceful and beautiful tree. Even when growing in its native swamps, hemmed in on all sides, and struggling for existence, the top and a branch or two near the top, will be marked by a characteristic elegance of shape which no other tree of the family possesses. It is entirely free from the stiffness of the pines, and to the spiry top of the poplar, and the grace of the cypress, it unites the airy lightness of the hemlock.

The white cedar connects the arbor vitæ with the cypresses. It has the characters of both; the scale-like, imbricate leaves and fan-shaped branches of the former, and the lofty port and globular or many-sided fruit of the latter.

In Massachusetts, it grows only in swamps which are inundated for the greater part of the year. Several of these, as between Boston and Mansfield, and Taunton and New Bedford, have been penetrated by rail-roads, but before then, the trees were nearly inaccessible, except in the middle of summer, or the heart of winter. The trunk is very straight and tall, tapering very gradually, and, towards the summit, set with short, small, nearly horizontal, irregular branches, forming a small but beautiful head, above which the leading shoot waves like a slender plume. The bark on the smaller branches is of a brownish or purplish green, often mottled with white lichens. On the trunk, it is reddish, scaling off in thin scales, thready, and broken on the upper part by furrows, which are deeper, nearer the base, on old trees. These are long, and run in a spiral line round the trunk once in thirty or more feet, indicating a corresponding twist in the fibres of the wood. The smaller branchlets are crowded, and irregularly divaricate, or fan-shaped, like those of the arbor vitæ. The recent shoots have a few opposite leaves scattered along their sides, the bases of which seem to form a part of the greenish bark. In two or three years, these leaves, with a portion of bark adhering to them, scale off, leaving the purplish brown bark of the branches and young stocks perfectly smooth, and resembling the bark of a cherry tree. The leaves are very small, scale-like, with triangular, sharp points, and imbricate in opposite pairs, forming four rows, completely covering the compressed ultimate branchlets, which seem to be compound leaves. Each leaf has, like those of the arbor vitæ, a minute tubercle on the back, near the base.

The flowers are extremely minute. The male consists of several shield-like scales, protecting about three stamens; the female, of a few opposite pairs of thickened scales, containing each two ovules, in bottle-shaped sacs. The fruits are compound, globose, or many-sided, (about ten—) cone-like heads, of the size of a large pea. These are at first green, afterwards

turn blue, and finally brown. They are mature in autumn, when they cast their minute, oblong, flattened seeds; but they usually remain on the tree for some time after.

The wood is white, or, when seasoned, of a faint rose color, light, soft, fine-grained, and very durable. It has a strong and permanent aromatic odor; and it resists for a long time the alternations of moisture and dryness. It is hence particularly suitable for fencing, for which purpose it is much used in the neighborhood of the cedar swamps. It is also employed in making shingles, and wooden vessels. For its lightness and durability, it is chosen for certain parts of whale-boats, for the streaks, ceiling or lining, plat-form, and stern-sheets; the frame-work being made of oak.

In its native swamps, the white cedars usually come up so thickly as almost to cover the ground, and when grown to the height of eight or ten feet, they form a perfectly impenetrable thicket. In this state they nearly cease to grow, and remain apparently stationary, till the hardier stocks outgrow, overshadow, and choke the weaker ones. These latter gradually die, making room for the slow growth of the survivors. If, at this stage, four out of five, or even nine out of ten, were thinned out, the remainder would be able to grow to an amount fully equal to the whole. This should always be done. The thinnings are an excellent material for fences. On the grounds of the late Joseph Anthony, of New Bedford, was a fence made of small white cedars, of a fashion worth imitating. A row of cedar stakes is set, at suitable distances, leaning all one way, at an angle of 45°. In contact with them another row is set, with the same inclination in an opposite direction. Where the contiguous stakes cross each other, they are fastened together with some pliant twig, like the young shoots of blue-fruited dogwood, (*Viburnum nudum*). Thus is formed a sufficient and ornamental fence, of great durability.

The white cedar has so many excellent qualities, that, in an industrious and manufacturing community, it can never cease to be valuable. It is one of those trees, therefore, which ought to be cultivated in great numbers, to supply the wants of posterity. Fortunately, it is one which can be cultivated with less

trouble, and at less expense, than any other forest tree, and it conflicts with no other. There are large tracts of cold, swampy land, which could be drained only at great expense, which might, in their present state, be made to produce valuable forests of this tree. It would be only necessary to gather the seed from the forests already growing, and cast it abundantly, in the fall of the year, upon the surface of the ground or water, in the morasses and swamps intended for this use. In six or eighteen months, the seeds will vegetate. In a few years, thinnings might be made, which, for enclosures alone, would pay a high rate of interest upon the value of the land, and of the labor bestowed.

There are several trees of the cypress kind that should be introduced for their beauty. The common cypress of Europe, a tall and graceful, plume-shaped tree, the common and suitable ornament for burying places in the Levant, succeeds in the open air in various parts of Britain, and would probably succeed in sheltered places here. Perhaps the oldest tree on record, is the cypress of Somma, in Lombardy. It is supposed to have been planted the year of the birth of Jesus Christ, and, on that account, is looked upon with reverence by the inhabitants; but an ancient chronicle at Milan is said to prove that it was a tree in the time of Julius Cesar, B. C., 42. It is one hundred and twenty-one feet high, and twenty-three feet in circumference at one foot from the ground. Napoleon, when laying down the plan for his great road over the Simplon, diverged from a straight line to avoid injuring this tree.*

A still more beautiful tree, not an evergreen, is the cypress of the Southern States, (*Taxodium distichum*). This is a noble tree. It often rises to the height of one hundred and twenty feet. In Bartram's garden, a tree of this species is the chief ornament of the place, among the best collection of trees in North America. At the Botanic Garden, Cambridge, it grows perfectly well, and has never been visibly affected by the severity of our winter.

* Loudon, IV, 2471.

I. 7. THE JUNIPER. *Juniperus*. L.

The junipers are evergreen trees or shrubs, found in all quarters of the globe. They are distinguished by their fruit, which is a three-sided, berry-like galbule, made up of several thickened, fleshy, coalescing ovaries, and usually covered with a bluish bloom. The leaves are opposite, or in whorls, narrow, stiff and pointed, sometimes minute and scale-like. The wood is more or less aromatic, and is very durable. The berries are employed in medicine as a diuretic, and to give its peculiar flavor to gin.

The species in Massachusetts are, 1. The Red Cedar, which is a small tree; and 2. The Common Juniper, a prostrate shrub.

Sp. 1. THE RED CEDAR. *Juniperus Virginiana*. L.

Figured in Michaux; Sylva, III, Plate 155.

By Bigelow; Med. Bot. III, Plate 45.

And in Loudon's Arboretum; VIII, Plate 298.

This is usually a ragged looking tree. In the neighborhood of Boston, it is commonly found on dry, rocky hills, where it sometimes attains the height of thirty or thirty-five feet. When it grows by itself on the open ground, it throws out several large limbs close to the earth, which, extending horizontally a few feet, and sometimes taking root, sweep upwards and often almost equal the main stem, forming together what seems to be a clump of small trees rather than a single tree. Surrounded by other trees in a wood, it has a smooth, clear trunk for twelve or fifteen feet, and a handsome spiry head. On the rocks it assumes every variety of form, round-headed, irregular, or cone-shaped, sometimes not without beauty.

The red cedar is distinguished from the white and the arbor vitæ, the only trees which it resembles, by having its fruit in the form of a berry, and its leaves exhibiting but slightly a tendency to arrange themselves in a plane. The trunk is straight, rapidly decreasing, and full of branches. It is often deformed

by holes produced by the loss of branches, and by knots left in the attempt to make it a shapely tree by pruning. It is covered with a bark, reddish within, and usually rough externally, with long, stringy, brownish, loose scales or ribbons, but when long exposed, smooth and whitish. The furrows separating the stringy scales, often take a slightly spiral direction, indicating a twist in the woody fibre similar to what is observed in the white cedar. The lateral, crowded, leafy twigs are alternate, and made up of four rows of leaves, imbricately arranged in opposite pairs, and connected by a thread of woody fibre. The leaves are very short, minute, fleshy, convex, and pointed, but not sharp, with a depressed gland on the outer side; each pair closely embracing the lower margin and base of the pair above it. On the growing shoots, the leaves are much longer, rigid, and sharp-pointed, in opposite and somewhat distant pairs, or threes. These leaves gradually turn light brown, like the bark, and in a few years scale off, leaving the now purplish bark perfectly smooth, which it continues to be till the branch is an inch or two in diameter, when the epidermis begins to crack and scale off. "A singular variety sometimes appears in the young shoots, especially those which issue from the base of the trees. This consists in an elongation of the leaves to five or six times their usual length, while they become spreading, acerose, considerably remote from each other, and irregular in their insertion, being either opposite or ternate. These shoots are so dissimilar to the parent tree, that they have been repeatedly mistaken for individuals of a different species."*

The barren and fertile flowers are on different trees, rarely on the same. The barren flowers are in small, terminal, oblong, yellowish brown aments, from one-tenth to one-fifth of an inch long, formed of four to six pairs of shield-like scales, each protecting about four yellow anthers. The fertile flowers are still more minute. They consist of, usually, six fleshy, oblong, obtuse, bluish or violet scales, in pairs, or threes, united at base,

* Bigelow's *Florula*, 2d edition, p. 370.—This disposition to the ternate arrangement, and acicular shape of the leaves, is very common in this tree, and, with its tendency to spread near the ground, shows its near relationship to the common juniper, a species of the same genus.

and containing one or two bottle-shaped, covered ovaries or germs.* About these germs the swelling scales coalesce, and form a roundish or obscurely four-sided berry, which is green, covered with a bluish powder, and marked with minute projections indicating the points of the once distinct scales. The seeds are one or two, covered with a bony shell, in the shape of a short cone, which is compressed on one side, when there are two. The flowers open in April or May, and the fruit is mature in October or November, but continues on the tree through the winter.

Though usually having little beauty, it may be made a handsome low or middle-sized tree, by careful pruning when young. If this is attempted too late, the tree is deformed by numerous knots. When growing in a dry but rich soil, in a sheltered situation, it is sometimes a fine tree. One such, eighteen inches in diameter, is growing near the country house of the late Thomas Rotch, Esq., near Philadelphia, which has a full, round, ample head, and is nearly forty feet high.

The wood is light, close-grained, smooth, and compact, and possessed of great durability. The agreeable and permanent odor recommends it for certain uses, as that of making pencils, and the bottoms of small boxes and drawers, the aroma making it a safeguard against insects. The sap-wood is white, but the heart-wood of a beautiful red, whence is derived its name. It is much used to make posts, which last many years. It is also used in the manufacture of pails and tubs.

The timber is highly valued by ship-builders, boat-builders, and carpenters, and by cabinet-makers, and turners. Dr. Elliott makes an observation in regard to the trees, as found growing in the Southern States, which holds true in several parts of New England. "Those which grow along the sea-coast, with their roots partially immersed in salt-water, though smaller in their dimensions, are much more durable than those which inhabit the forests. Often when surrounded and finally destroyed by the encroachments of the salt-water, their bodies remain in the

* The necks of these bottle-shaped bodies, which are in fact only openings to the naked ovary, have till recently been mistaken for pistils.

marshes for an indefinite period, the roosting places of vultures and of sea birds, become incrustated with pulverulent lichens, and seem to moulder away like rocks, rather than decay like a vegetable product.”*

Dr. Bigelow† expresses a doubt as to the essential difference between our red cedar and the savin of Europe, whose name it often bears; and Sir William J. Hooker refers both, without hesitation, to the same species. The medicinal properties of both are the same; a decoction of the leaves having a stimulating effect, when used internally, in cases of rheumatism; and serving to continue the discharge from blisters, when used in the composition of a cerate for that purpose. The Baskshirs, a people of Russia, between the Volga and the Oural, use a fumigation of savin for diseases of children, and attribute to its branches, hung at their doors, great virtue against witches.

From the exposed situations in which the red cedar grows, it often has to assume fantastic shapes. On the Jerusalem road at Cohasset, which leads along the top of a high sea-wall for some distance, exposed to the winds from the sea, is a tree

* Botany of South Carolina and Georgia, II, 717. I subjoin the following excellent remarks, from the Arator, as quoted in the New England Farmer, VIII, 381, upon the use of the red cedar for the purpose of a hedge:—

“The cedar is peculiarly fitted for the purpose of live fences. It throws out boughs near the ground, pliant and capable of being woven into any form. They gradually, however, become stiff. Clipping will make cedar hedges extremely thick. No animal will injure them by browsing. Manured and cultivated, they come rapidly to perfection. The plants are frequently to be found in great abundance without the trouble of raising them. As an evergreen, they are preferable to deciduous plants; and they live better than any young trees I have ever tried.” They should be planted with a sod taken up of sufficient size to prevent injury to the roots, between December and the middle of April, on each side of a fence, the plants and rows being each two feet apart, and each plant in one row opposite the centre of the interval between two successive plants in the other row. “They should be topped at a foot high, and not suffered to gain more than three or four inches yearly in height, such boughs excepted as can be worked into the fence at the ground. Of these, great use may be made towards thickening the hedge, by bending them to the ground, and covering them well with earth in the middle, leaving them growing to the stem and their extremities exposed. Thus they invariably take root and fill up gaps.”—See Arator for more particulars as to their management, or New England Farmer, as above.

† Med. Bot., III, 50.

which measured five feet three inches in circumference at two feet from the ground, and four feet three inches at five feet. The trunk is much bent, and all the branches violently twisted landward by the northeast wind, which pours in upon it from between two hills. The smooth bark is nearly covered with *parmelias* and other lichens.

Another, near the same place, lies prostrate on the rock from beneath which it springs. It has a circumference of five feet three inches as near the root as it can be measured, and six feet eight inches at the largest part free of branches. These, numerous, crowded and matted, bend down like a pent-house, over the side of the rock. Others are seen on the same road, as if crouching behind walls; rising higher and higher as they recede from the walls, and forming protected, sunny spots for sheep to lie in.

An old tree of red cedar on J. Davis's land in Roxbury, nearly opposite the summer residence of E. Francis, Esq., is one foot four inches in diameter at four feet from the ground.

This tree, of which there are many varieties, is found, in America, from the Saskatchewan, in Canada, in latitude 54° , as far as Georgia, Florida, Louisiana, the Bermudas and Barbadoes Islands, around the Gulf of Mexico beyond St. Bernard's Bay, and through the Western States to the Rocky Mountains. It abounds in Europe and northern Asia, as far as the Crimea and the Oural, having thus a geographical range equal, perhaps superior, to any other tree known.

On the branches of the red cedar are often found excrescences, which, when fresh, are of a tough, fleshy consistency, enclosed in a reddish brown bark. On drying, they become of a woody texture. On the last day of June, a mild, rainy day, these were found, every where, enveloped by an orange-colored substance in threads an inch or more long, and one or two lines thick, gelatinous, of little consistency, and full of cells, each thread issuing from a circular or polygonal depression. On the following day, they were all beginning to dry up, and in a few days, scarcely a trace of the gelatinous substance remained.

These cedar apples, as they are called, are commonly supposed to be produced by the action of some insect. They are,

however, found to have quite a different origin. They make their appearance, according to Schweinitz, from whom this account is obtained, on the most delicate branches of the cedar, of the size of the head of a pin, and gradually increase to the diameter of one or two inches, still traversed by the unaltered branch. Whilst fresh and young, their substance is like that of an unripe apple, and of a whitish green color within. This green tint soon changes to a tawny orange, and a few whitish fibres are observed radiating and branching from the base. They are covered with a bark of a brown purplish lilac color, which is juiceless, like the peel of an apple. The whole surface is dotted with small polygonal, usually pentagonal, depressions, which are at first plane, afterwards slightly projecting in the centre. These projecting centres at last burst, and there issue forth from each, in moist weather, slender, gelatinous, strap-like "*sporidochia*, about an inch in length, of the most beautiful orange color, adorning, in the course of a single spring night, the whole tree, as it were, with the richest crop of ripe oranges. If wet weather continues for many days, it remains in this state till the ligules melt away. Under the influence of the sun, however, they soon dry up, and never revive." This gelatinous substance is composed of the lengthened sporidia, spore-vessels, or seed-vessels, of a minute fungus, called by Schweinitz *Podisoma macropus*. Dr. J. Wyman has discovered one of these fungi so constantly near the lengthened acerose leaves, mentioned above, that he conceives there must be some connexion between them, and that the fungus is, perhaps, the cause of the peculiarity in the length and shape of the leaf. I believe, however, that acerose leaves occur on perfectly healthy branches. The cedar apples continue to increase until the sporidochia burst forth; but after this evolution has taken place, they cease to grow, and begin to become hard and dry. They last a year. When dry and old, they are of a spongy, fibrous texture, finally almost woody, as if formed of fibres radiating from the base.* On each of the junipers of Britain a similar fungus is found.

* See a communication from Dr. J. Wyman, in the forty-second number of the London Journal of Botany, with additional remarks by the Rev. M. J. Berkeley.

Sp. 2. THE JUNIPER. *J. communis.* L.

Figured in Dr. Bigelow's Medical Botany ; III, Plate 44.

The stem of the juniper is always completely prostrate upon the surface of the earth, or sometimes just beneath, with the branches spreading in every direction, rooting and forming large beds. It is covered with a soft, reddish, scaly bark. The extremities of the branches are slightly ascending. The branchlets are very short and horizontal, or curved downwards, with a yellowish green bark which afterwards turns brown, and with long, rounded protuberances between the leaves. The leaves are in whorls of three, short, linear, sessile, rigid, curved at base, ending in a sharp point or bristle, concave towards the extremity of the branch, bright green on one side, and on the other, which, if the branch were erect, would be the upper side, white or glaucous along the middle. The barren and fertile flowers are on different plants. The barren are in short, solitary aments, situated in the axil of the leaves, made up of three or four whorls of scales, and set round at base with one or two whorls of very minute sharp leaves. Each scale is shield-like, rounded on one side, and pointed on the other, and protects about four anthers. The fertile flowers are also axillary, on a stout stalk invested with numerous minute, pointed scales, in four rows. Each flower consists of three fleshy scales, adhering at base, and separate only at the triangular points, within which are three bottle-shaped bodies containing each a germ. The fruit is a roundish, flattened berry, of a dark purple color, formed of the enlarged, fleshy scales, whose points are marked by three slight prominences, separated by as many lines meeting at a common centre. Each berry contains three stony nuts, enveloped in a mealy substance nearly destitute of taste.

The juniper seldom rises more than a foot or two from the ground, but spreads extensively in every direction, sometimes covering several acres of the surface of dry rocky hills, and giving great trouble to the cultivator, as it is very difficult to extirpate. It is commonly destroyed by burning, and little use is made of the wood.

In Europe, where there are several varieties, one of which exactly resembles ours, the wood is much valued, for its aromatic odor and its beauty, it being finely veined, of a yellowish brown color, and taking a high polish. It is used for walking-sticks, and for various small articles of the turner. "It makes excellent fuel, and is used, in Scotland and Sweden, for smoking hams. The bark is made by the Laplanders into ropes."* The berries are principally used in making gin, which is a spirit obtained by distilling grain, flavored by an infusion of these berries. "They are used by the peasants in some parts of France, to make a kind of beer, which is called *genévrette*. For this purpose they take equal parts of barley and juniper berries, and, after boiling the barley about a quarter of an hour, throw in the berries. They then pour the whole into a barrel half full of water, and bung it closely for two or three days; after which, they give it air to promote fermentation. Some persons add molasses or coarse sugar, to make the liquor stronger. This beer is ready to drink in about a week, and it is bright and sparkling, and powerfully diuretic."* The berries are also used in medicine. When distilled, they yield a large quantity of pungent, volatile oil, of the peculiar flavor which is perceived in gin. In this oil the medicinal properties of the berries are supposed to reside.† They have decided diuretic virtues, on which account they have been long and extensively employed in dropsical affections and in diseases of the kidneys.

* Loudon, IV, 2493.

† Bigelow, Med. Bot., III, 45.

SECTION THIRD.

I. 8. THE YEWS. *Taxus*. L. Order *Taxaceæ* of Lindley.

By some authors, the yews, with several associated genera, have been separated from the other evergreens, and made to form a distinct family. They are distinguished by their fruits not being collected in cones, but each ovule growing singly, unprotected by hardened scales; so that the mature fruit has no resemblance to those of the true pines.

They are natives of temperate climates in all the quarters of the globe, and are occasionally found in hot latitudes; but are nowhere common. They are resinous, like the true pines, and have similar properties. The wood of the European yew is famous for its toughness, and, before the invention of fire-arms, was highly valued as the best material for bows; according to Spencer's descriptive line—

“The eugh obedient to the bender's will;”

and the name *taxus* is supposed to be derived from the Greek name for bow, *toxon*, (Τοξον.) The English name is the Saxon Iw or Eow, hardly changed.

The European yew, of which ours is considered a variety, is remarkable for the hardness, weight, and extreme durability of its wood, which is red and beautifully veined and knotted, and valued by the turner and cabinet-maker. It is a very long-lived tree, though of slow growth, of slower growth and greater durability than any other European tree; and it is one of those trees which best support the opinion of physiologists, that exogenous trees are, by their nature, of indefinite growth; that they never die except by a violent death. A yew in Braburne churchyard, in Kent, was nearly twenty feet in diameter; and there is one in the woods of Cliefden, “called the Hedron yew, still in health and vigorous, which measures twenty-seven feet in diameter.”* The leaves of the yew are poisonous to cows and horses, though eaten with impunity by many other animals.

* Burnett; Outlines, I, 506.

THE YEW. GROUND HEMLOCK. *Taxus Canadensis*. Willdenow.

The European variety figured in Loudon; Arboretum, VIII, Plate 293, and on pages 2074, 5, 7, 8, 9; and by Strutt, in Sylva Britannica.

In various parts of the western counties of Massachusetts, occurs a humble, almost prostrate evergreen, conspicuous for the rich and deep green of its foliage. It is the American yew. The road which leads from Pittsfield to Williamstown, after following up the valley of the Housatonic to its extremity, and crossing a low ridge of hills which supply some of its upper streams, descends the northern declivity and enters the valley of the Hoosic, with the magnificent Green Mountain range on the right, and the Hoosic Mountains on the left. Every traveller will remember a deep gorge, where he passes for some distance under the shade of lofty trees, the rock maple, the white and yellow birch, and the hemlock, by the side of that wild and noisy stream, not yet visible. On emerging, and getting a sight of the river and its banks, he will perhaps remember,—if he is a lover of trees he cannot forget,—on the right bank, at the very foot of the mountain, along which the stream runs, and shaded from the morning's sun by the trees which clothe its side, a mass or long bed, of the most vivid and delicious green. The American yew grows there in great luxuriance.. The traveller will be well rewarded for picking his way across the rocky river, to examine it. It delights in such scenes, and perhaps nowhere flourishes in greater beauty than on that spot.

The stem of the American yew trails on the ground or just beneath the surface, to the distance of six or eight feet. Beneath the surface, it is covered with a smooth dark purple bark; where it protrudes above, it takes a grayish brown color. The terminal stems are slightly ascending; irregularly branched with crooked branches. The recent green shoots are very small and slender, with two slightly projecting ridges below the base of each leaf. The leaves arrange themselves in two rows; they are close set, half an inch long, linear, flattened, rounded at the base, and very pointed at the extremity, with the mid-rib slightly pro-

jecting on both surfaces. They are supported on short, green, hair-like footstalks.

The fruit is a kind of berry, of a rich scarlet color, formed of the fleshy calyx, embracing the dark-colored, oval nut. When half grown, and green, it has a striking resemblance to an acorn.

For the sake of the very rich green of the yew, it might be cultivated beneath other trees, its natural habit, to take off the bareness of the surface of the ground; especially under ever-greens planted near a dwelling-house.

The American yew is often called ground hemlock. It is found at Otis, and in various other places along the Green Mountains. A vigorous stock of it may be seen at the Botanic Garden.

The wood of the yew is of a yellowish brown color, very heavy, tough, and elastic. The Indians often made their bows of it :—

“Their bows of double fatal yew.”

This tree is found, prostrate, in Newfoundland, on Lake Huron, in Canada as far as the Saskatchewan; on the banks of the Columbia, Mr. Douglas assures us, it attains a size equal to that of the yew of Europe.*

* Hooker, Flor. Bot. Am. II, 167.

CHAPTER II.

AMENTACEOUS PLANTS. *AMENTACEÆ*. JUSSIEU.

THE characteristic of this great division of plants is the arrangement of the flowers, of one or both sexes, in aments or catkins. It consists almost entirely of trees, many of them of the largest size, with a watery juice or sap, and simple, or compound, alternate leaves, which fall at the approach of winter, and are reproduced after, or sometimes with, the flowers of the succeeding season. The leaves have a mid-rib extending from one extremity to the other, and are accompanied by small, leaf-like appendages, called stipules, on each side of the footstalk, which expand with them, apparently for their protection, and soon fall off; or, in a few instances, remain as long as the leaves. The two sexes are in distinct flowers, sometimes on the same, sometimes on different trees. The male flowers are disposed in aments, which are made up of simple, stamen-bearing scales, or of cup-shaped leaves within or by the scales, containing the stamens. The female flowers are in aments, or are bud-like, or in fascicles. The wood is remarkable for its economical value, sometimes for its strength and durability; the bark, for its thickness, and for the abundance of the astringent principle of tannin which it contains.

Eight families, some of them of the greatest importance, belong to this division:—The Oak, the Hornbeam, the Walnut, the Birch, the Gale, the Plane, the Willow, and the Mulberry.

FAMILY II. THE OAK FAMILY. *CUPULIFERÆ*. RICHARD.

The oak family, the glory of the woods, and the friend and nurse of our race in its infancy, yields to few others in its importance to mankind. The oak, the chestnut, the beech and the hazel are every where, throughout all temperate regions, known and valued. In northern regions they are abundant; and they occur, though not in great numbers, in the southern

hemisphere. A few are found upon the mountains within the tropics, but are unknown in the valleys.

It was formerly considered a part of the much larger family of Amentaceæ. As now constituted, it is a strictly natural family. The trees which belong to it are remarkable for their thick and rugged bark, and for the great abundance of the principle of tannin which it contains. They have large and strong roots, penetrating very deep, or extending very far, horizontally, beneath the surface, and sometimes, as in the case of the oak, both. The trunks are distinguished for their massiveness, and for the weight, strength, and, in most cases, the durability of their wood, and its preëminent importance in the arts. Their branches are long and irregular, and form a broad head of greater depth than belongs to the trees of any other family.

The buds are fitted for a climate with severe winters, the plaited or folded leaves being covered by imbricate, external scales, and, often, still further protected by a separate, downy scale, surrounding each separate leaf. The leaves are plane, and alternate, and usually supported by a footstalk, at the base of which are two slender leaflets or stipules, which, for the most part, fall off, as the leaf expands.

The fruit is valuable as food to man and the animals dependant on him. The fruits of the chestnut and hazel have been long cultivated on the Eastern continent, and much improved in size and quality. All are doubtless susceptible of it; but the life of these trees is so long, in comparison with the duration of man, that experiments for this purpose must be carried on by successive generations.

This family includes trees and shrubs whose male and female flowers are separate, but on the same trunk. The male flowers, which appear early in the spring, are in long tassels called aments or catkins, made up of a great number of separate, cup-shaped, jagged scales or membranous leaves, to the base or side of which, beneath or within, are attached the stamens, from five to twenty in number. The female flowers are usually bud-shaped. The ovaries or seed-vessels are seated within a leathery cup or involucre, are surrounded by an irregularly toothed calyx, and tipped with several stigmas. They contain

one or several ovules, only one of which comes to maturity. The fruit is a bony or leathery, one-celled nut, partially or entirely enclosed in a cup. It contains one, two, or three pendulous seeds. The embryo is large, the cotyledons being the halves of the fleshy fruit. The radicle, or future root, is minute, situated at the top of the nut, and, in germination, is the first to make its appearance.*

The genera found in Massachusetts, are the oak, the chestnut, the hazel, and the beech.

II. 1. THE OAK. *Quercus*. L.

“The Unwedgeable and Gnarled Oak.”

By the Pelasgians, who, before the Greeks, occupied the land afterwards so illustrious for the arts and civilization of its inhabitants, and by the fathers of our Celtic ancestors, the oak was invested with a sacred character. In the oak woods, which gave him shelter and food, the Pelasgian believed there dwelt a deity, whom, in the awful solitude, he feared and worshipped. There were never wanting some to avail themselves of this superstition, and from the oak trees of Dodona came an oracular voice which was listened to with a faith which accomplished its predictions. Still more sacred was the oak to the inhabitants of Britain and Gaul under the Druids.† The oak groves were their temples, and the mistletoe which grew on the oak, an object of still greater veneration, was the wand of the druid. This, like every other superstition, must have had its origin in reason. And for what better foundation need we look, than the majesty, the durability, the beauty, and the many useful properties of the oak?

Among the earliest inhabitants of Europe, with whom most of the fruits now used were not indigenous, the acorn was an

* The cup of the acorn is an involucre, formed by the growing together of a great number of little bracts; and the acorn is a fruit formed by the adhesion of an ovary to the calyx. One of the ovules increases rapidly after its fecundation, and renders the others abortive, either by attracting the sap or by obliterating the threads of the pistillate cord.

† The name druid is supposed to be derived from a Celtic word, *dry*s, which, like the corresponding word *drus*, (*δρυς*), in Greek, signifies *oak*.

important article of food.* Even now, the fruit of some species of oak, is not considered unpleasant, and in the Morea and in Asia Minor, acorns are sold as food at the present day. The elder Michaux says,† that he, as well as the naturalist Olivier, has verified this fact; and he reports that, at Bagdad, he ate excellent acorns, as large and long as one's finger, the production of Mesopotamia and Curdistan. He also ate with relish the acorns of Spain, where, indeed, they are constantly eaten, as chestnuts or walnuts are here. There are probably few persons who have spent their childhood in any country town in New England, who have not found the acorns of the white oak, especially when roasted, a tolerably pleasant substitute for inaccessible walnuts and chestnuts.

But if we sometimes reject the fruit, there are many other animals, not so fastidious. The oak is found growing naturally in all parts of the northern temperate zone, in Europe, Asia, America, and the northern parts of Africa; and, in all, contributes to the subsistence of a great variety of animals. In Europe, the stag, the roc-buck, and the wild boar, winter upon its fruit. In Asia, pheasants and the wood-pigeon share it

* The Greek and Latin words which we translate acorn, comprehended many kinds of fruit which are still considered agreeable food. The Arabs are said to give the name *tamar* to the fruit of the date-tree, and, when they wish to designate any other fruit, they add a specific name to this. Thus, the tamarind, is the *Tamar-Hendi*, or date of India. So the Greek word *balanos*, (*Βαλανος*), signified not only *acorn* but *date*, *chestnut*, *beechnut*, and several other fruits; and the persons employed to gather acorns were called *balanistæ*, (*Βαλανισται*), as well as those who gathered dates. The Latins used the word *glans*, a word of the same origin, much in the same manner. Alone, it signified the fruit of several kinds of oak. The date was called *glans Phænicea*; the chestnut, *glans Sardiana*; the walnut, *glans Jovis* or *Juglans*. In a similar manner is the word *gland* used among the French, who call the fruit of the oak, the beech, or the chestnut tree, *gland de Chêne*, *de Hêtre*, *de Chataignier*. And the word acorn in our own language seems to have come from the generic word, corn, kernel,—united to *aac*,—the old name of oak. We may then safely presume that those Arcadian acorn eaters, (*Βαλανηφαγοι*), whom Plutarch reports to have been held invincible, because they made their principal food of acorns, did not always confine themselves to the dry and bitter nuts that we so call, but indulged a reasonable preference for the dates, chestnuts and walnuts, included by them under the same name, and which even we sometimes suffer to make their appearance in an after course.

† Histoire des Chênes, p. 3.

with animals of the deer kind.* In our own native forests, the bear, the racoon, the squirrel, the wild pigeon, and the wild turkey, delight in various kinds of acorn, and the hardly less wild swine fatten upon them.

In England, whose oak forests are now one of the sources of national wealth and naval supremacy, the tree was once prized only for the acorns, which were the chief support of those large herds of swine, whose flesh formed so considerable a part of the food of the Saxons. "Woods of old," says Burnett,† "were valued according to the number of hogs they could fatten, and so rigidly were the forest lands surveyed, that in ancient records, such as the Doomes-day Book, woods are mentioned of a "single hog." The right of feeding hogs in woods, called *Pannage*, formed, some centuries ago, one of the most valuable kinds of property. With this right monasteries were endowed, and it often constituted the dowry of the daughters of the Saxon kings."

The oak is peculiarly subject to attacks of insects, which cause a great many varieties of galls; some kind being found on almost every part of the tree. These were once supposed to be the fruit of the tree. The most important is that known in commerce as the gallnut, and imported in large quantities into this and other countries from Aleppo, and other ports in the Levant. This is produced by the puncture of an insect called by Olivier, in his travels, *Diplolepis gallæ tinctoriæ*, which deposits an egg in each puncture, which immediately causes a swelling about the size of a walnut. The oak, on which this takes place, is a small, shrubby species, called the *Q. infectoria*, common in all parts of Asia Minor and Syria, and valuable only for the gallnuts. Oak galls are among the most powerful vegetable astringents known, and form the basis of many styptics and astringent medicines. An infusion of them is said to be the best antidote for an over-dose of ipecacuanha.‡

An insect found on a species of oak growing in the Levant,

* Histoire des Chênes, p. 4.

† Outlines, 532.

‡ Burnett, Outlines, 535. Galls contain a peculiar astringent principle, called gallic acid, which strikes a deep purple color, gradually becoming black with the soluble salts of iron. This property renders them a valuable dye-stuff. Hence their request with dyers. They also form the basis of common black ink.

called *Quercus coccifera*, was for many ages used for the purpose of communicating crimson and scarlet colors. This continued to be the case until its place was taken by cochineal, the product of another similar insect, found on a species of cactus which is a native of Mexico.

As growing in New England, none of the forest trees have more numerous enemies of the insect race than the oaks. Their leaves are fed on by the slug-caterpillar, (*Limacodes*; Harris's Report on Insects, p. 304,) and by the caterpillar of the hag-moth, (*Limacodes pithécium*, ib. 304); they are rolled up and destroyed by the leaf-rollers, (*Tortrices*, ib. 347); and devoured by the scarred *Melolontha*, (*Melolontha variolosa*, ib. 30), a beautiful beetle of a light brown color. The juices of the small twigs are sucked by the white-lined tree-hopper, (*Membracis univittata*, ib. 180); their leaves are sometimes stripped by the tent-caterpillar, (*Climacampa sylvatica*, ib. 271); by those of *Pelasia ministra*, (Drury, II, 28); by those from which proceed the beautiful *Luna* and *Polyphemus* moths*; by the tawny caterpillar of the large *Ceratocampa imperialis*, (ib. i, 17; plate ix, 1 and 2); by the stinging caterpillar of the rare *Saturnia Maia*, (Harris, 285); and more extensively than by any other, by the oak caterpillar, (*Dryocampa*, ib. 291).

The oak-pruner, (*Elaphidion putator*, ib. 81,) a long-horned beetle of a dull-brown color, lays its egg in the axil of a leaf, or of a small twig, near the extremity of a branch. The grub, when hatched, penetrates to the pith, and then continues its course towards the body of the tree, devouring the pith, and forming a cylindrical burrow several inches in length. It ends by severing the wood of the branch, leaving it to be broken off and precipitated to the ground by the autumnal winds. By this untimely pruning, the ground is often strown with branches, some of them an inch in diameter and five or six feet in length. If these are collected in autumn and burnt before the ensuing spring, the development of the beetles is prevented, and future evil guarded against.

* Harris, pp. 282—3. Dr. Harris is of opinion that the strong silk, forming the large cocoons of these insects, might be substituted for that of the common silk-worm.

A more dangerous enemy is fortunately of much more rare occurrence. The oak woods in some parts of the Old Colony, are, at distant intervals, alarmed by the shrill, discordant rattle of the seventeen-year *Cicàda* or locust.* They sometimes come out of the ground in such multitudes as, by their weight, to bend and even break the limbs of the trees. Their long subterranean residence has sufficed for the other ends of existence; they come to the light only to propagate and die. Their eggs are deposited in great numbers in the pith of the smaller branches of the oak, which are thus destroyed; are broken off by the winds or by their own weight, and remain hanging by the bark, giving a gloomy appearance to the woods; or they fall with their withered foliage to the earth. This, if annually repeated, would be a fatal scourge. The long periods which intervene before the return to the surface of the succeeding generation, alone preserve the forests from entire destruction.

Still more fatal are the ravages of those insects which invade the trunks of the oak trees. The larvæ of one of the Buprestian beetles, (*Chrysobôthris femorata*, ib. 4—5), bore into the trunk of the white oak; those of the timber beetles, (*Lymécylon* and *Hylecatus*, ib. 52), make long cylindrical burrows in the solid wood of the oak, while standing in health; grubs of the northern *Brenthus*, (*Arrhenodes septentrionalis*, ib. 61), make similar burrows in the trunk of trees which are beginning to decay, and especially in those that have been cut down, which are attacked during the first summer after they are felled; the larvæ of the gray-sided *Curculio*, (*Pandeletèius hilaris*, ib. 62), make their habitation in the trunk of the white oak; and the grubs of the horn-bug, (*Lucànus caprèolus*, ib. 40), live in the trunk and roots of old oaks, as well as in those of several other species of trees.

The white oak is liable to the attacks of an insect, which punctures the small branches and introduces an egg, which has such an effect upon the juices of the tree, as to form upon the

* *Cicàda septendecim*. Harris's Report on Insects, pp. 167—175. See the passages here referred to for a most interesting account of these insects. Though called locusts in this country, they are very different from the locusts of history, which are grasshoppers.

side of the branch a spherical gall of one-fifth to one-quarter of an inch in diameter. These are found single, or two or three together, near the extremities of the smaller branches. If cut open in winter, they expose a worm or chrysalis folded up within a bony case.

For an account of the modes that have been devised to prevent or remedy the mischief done by so many enemies, I must refer to the Report of Dr. Harris, to whom I am indebted for almost the whole of what I have given above, and who has done more than all other persons in the investigation of the difficult subject of the habits and ravages of the insects of Massachusetts; more, indeed, by original observation, than has ever before been done, by any person, in any country or State whatever. Care and precaution may do something; but against many of these insects the unassisted efforts of men can accomplish very little. Most of the birds, probably all of them, the smaller quadrupeds, and all the reptiles come to our aid and wage perpetual war upon the insect tribes. The woodpeckers and the creepers do what they can to keep the bark of trees free; the fly-catchers take care of the leaves; a single flock of wild pigeons will do more than an army of foresters against the large solitary caterpillars which infest the oak forests.

The bark of most species of oak contain the tannin principle. The cups of the Velani oak are used for dyeing and for tanning. Both purposes are effected by the bark of our common black or yellow bark oak. The bark of a species of oak which grows in Spain, *Quercus suber*, furnishes the invaluable substance, cork, which is used in the countries where it is produced, not only for the purposes to which we apply it, but also as a lining and a carpet in brick or stone habitations.

The bark of most of our oaks is useful to the tanner, particularly that of the white oak, the chestnut oaks, and others of the same group.

Yet the great value of the oak, in all countries, is for its wood. It is applied to a greater variety of important purposes than that of any other tree. With the exception of the teak tree, it forms the best ship timber known; and, for this purpose, the white oak is, perhaps, equal to the English oak, and surpassed

only by the live oak. It was used for the frames of buildings, in preference to any other timber, until it became too scarce and dear. For strength, hardness, toughness, and durableness united, it is unsurpassed, although each of these properties singly is found in a greater degree in some other wood. It is almost indispensable in the manufacture of implements of husbandry, and in all kinds of wheel-work. It makes the most valuable tables and chairs, and it would be used by the joiner, on account of its superior beauty, for the finishing of houses, were it not for the property which shows its superiority, its hardness. When employed for ornamental uses, the wood should be cut obliquely to exhibit the reddish silver grain. As an ornament to the landscape, or as a single object, no other tree is to be compared with it, in every period of its growth, for picturesqueness, majesty, and inexhaustible variety of beauty.

The main root of the oak, where the soil is favorable, descends to a great depth, compared with its height, especially in young trees, and it stretches to a distance horizontally, and that at a considerable depth, equal to the spread of the branches, thus taking a stronger hold of the earth than any other tree of the forest. It does not often tower upwards to so magnificent a height as many other trees, but, when standing alone, it throws out its mighty arms with an air of force and grandeur, which have made it every where to be considered the fittest emblem of strength and power of resistance. And deservedly;—no tree in New England is to be compared to the oak in this respect, save the tupelo, and that in very rare instances. Nothing gave so vivid an impression of the irresistible force of the wind, in the great hurricane of 1815, as its laying prostrate even the oak. For, commonly, the oak braves the storm, to the last, without yielding, better than any other tree. The limbs go out at a great angle, and stretch horizontally to a vast distance. This, with the great size of the limbs, is its striking character, and what gives it its peculiar appearance. They do not always go straight out, but crook and bend, to right and left, upwards and downwards, abruptly or with a gentle sweep. The smaller branches preserve, in a considerable degree, the character of the limbs, and the spray varies with the species. So do the leaves;

although, in the several species of the same group, there is a striking similarity, and I have gathered from the same stock, leaves which would seem to belong to several different species. Indeed, the nearly allied species are not to be distinguished by their leaves alone, viewed at any one season.

The oak is distinguished from all other trees by its acorn, for which the fruit of no other tree can be mistaken. The leaves of all the species are larger towards the extreme end; in some, they are more or less deeply lobed, with rounded or blunt lobes; in others, toothed with large, round teeth; in others, deeply cut, with the divisions terminating in a long, bristle-like point, called a mucro. All the leaves are more or less downy while young, and many retain the down on the lower surface, when mature. The leaves of young plants, and of sprouts from the stumps of trees, are usually much more entire, as well as larger, than those on the mature tree. They come out late, and with them, or just before, the flowers. These differ less than the fruit, by which alone can some of the species be satisfactorily distinguished.

The stipules are membranaceous and perishing. The oak has but little medulla, but it continues in very old trees.

The flowers of both sexes are on one plant; the sterile disposed in long, slender, pendulous catkins, which are in groups; the fertile flowers in a bud-like, scaly cup. The ovary or seed-vessel of the fertile flower is divided into three compartments or cells, in each of which are two embryo seeds or ovules; but only one ovule in one of the cells comes to perfection; hence the fruit is a one-celled, one-seeded acorn, surrounded at base by the enlarged, scaly cup.

The acorns of the different species differ in being long and narrow, or short and round, pointed or blunt, on footstalks or sessile, and particularly in the scales of the cup in which the acorn is set. The acorns of some species come to maturity in a single season, but a considerable part of the New England species require two seasons to ripen. There is scarcely any seed in which the vitality is so transient, at least when the acorn is preserved artificially. Few of them will germinate after having been kept a year. Most of the oaks, those particularly

which belong to the white oak group, are shy bearers. Those allied to the red oak bear more freely. It is, however, uncommon to find any bearing abundantly, two years in succession. Most of them, except the shrub oaks, must be trees of considerable height and age before they begin to bear. But they become more fruitful as they grow older, and continue bearing to the last.

The rate of growth of the oak is very different in the different species, and depends much, like that of every other tree, on the soil, and on the exposure. If raised from the acorn, it requires much shelter when young, and on all except very rich soils, makes slow progress at first, although stumps of young and vigorous trees throw up shoots often of five or six feet in a single year. As it is slow in the early stages of its growth, it continues to make steady progress for many years, and requires one hundred or one hundred and fifty years to come to perfection.* From measurements upon a great number of trees recently felled, and from many specimens of the wood, of all sizes and from various soils, I believe that the average growth of the white oak is not far from two inches in diameter in ten years, after it has been growing thirty or forty years; the circles of growth, after that age, being about ten in an inch.† Before that age the growth is more rapid, but extremely various. An oak of thirty years may be eight inches in diameter and forty feet high. At or below this age it is commonly considered most profitable to fell for fuel; and it doubtless is so when it is to be renewed from the stump. But an easy calculation shows, that, although its apparent growth after that age is less than before, the real growth of each individual tree is greater. In ten years more it will be ten inches in diameter. Two inches will have

* De Candolle found the circles in very old oaks, cut in the forest of Fontainebleau, continued to increase to the thirtieth or fortieth year; from thirty, to fifty or sixty, diminished a little; between fifty and sixty became nearly regular, and so continued to the end. Past sixty, the increase is eight to ten lines in diameter, in ten years; two or three inches when between twenty and thirty,—indicating a cutting every thirty years.

† I give here memoranda of some of the oldest of these trees. On one, I counted 125 rings of growth in $11\frac{1}{2}$ inches; on another, 147 rings in $12\frac{1}{2}$ inches; on the third, 150 rings in $21\frac{1}{2}$ inches; on the fourth, 179 rings in 21 inches.

been added throughout the whole forty feet, though not much, probably, will have been added to the height. Now, as the growth must be estimated by the squares of the diameters, the solid wood in the lower part of the trunk will have increased in the proportion of 100 to 64. In the next ten years, it will increase in the proportion of 144 to 100; in the next ten, in that of 196 to 144; and in the next, in that of 256 to 196. The numbers after them will be 324, 400, 484. The successive additions, in periods of ten years, will be as the numbers 36, 44, 52, 60, 68, 76, 84, 92, 100. A tree of thirty years, therefore, in ten years, will increase 56 per cent.; in the next similar period, 68 per cent.; in the third, 79; in the fourth, 93; in the fifth, 106. That is, an oak of eighty years of age grows more in ten years than it did in the first thirty; and an oak of one hundred and thirty years, more than in the first forty. When, therefore, it is desirable to keep the growth for timber, the process of thinning may be continued with strict economy, as the increase of the thirty or forty trees left on the acre, will counterbalance, in a great degree, the loss in numbers. Some acres, in every large forest, should be thus left, for the use of the ship-builder.

Those species of oak most analogous to our white oak, are known, in Europe, to continue to grow and flourish for centuries. There are oaks in Britain, which are believed to have been old trees at the time of William the Conqueror. Some are known, which are supposed to be one thousand years old.

The number of species of the oak known to botanists, is very great. In 1823, the whole number was one hundred and thirty; (*Dictionnaire Classique d'Histoire Naturelle*;) since which time a considerable number has been added. Loudon estimates them at present at one hundred and fifty. This number is probably over-stated, as many that are considered species, will doubtless be found to be varieties. Sprengel enumerates more than one hundred oaks, the larger part natives of this continent. The elder Michaux described twenty, the younger, twenty-six, as natives of North America. Pursh described thirty-four as belonging to North America. Nuttall, in 1817, mentioned thirty-two as belonging to North America. Eaton describes thirty-six as found north of the Gulf of Mexico. Beck, twenty-three, as

belonging to the Northern and Middle States. I have found eleven in Massachusetts, growing in considerable numbers. I have probably overlooked several, but they must be stragglers. Two only are natives of Britain; eight of France, (*Flore Française*,) though the number is increased by some botanists to fourteen. Twenty-four species were found by Humboldt and Bonpland in Mexico; half that number have been found in the temperate regions of India, and sixteen in Java, (London, III, 1722.) The oak is found in the northern regions of Africa, but is abundant only in the temperate regions of both continents, avoiding equally the extremes of heat and cold.

The most natural arrangement of the oaks, seems to be that adopted by the elder Michaux. He divided them into two sections, according to the character of the leaves: the first, comprising those species whose leaves are destitute of flexible points or bristles; the second, those, the segments of whose leaves are mucronate, or terminate in bristles. A very important difference is also observed in the length of time required for the blossom to bring its fruit to maturity. Most of the oaks of Europe blossom in the spring, and mature their fruit the same season; and this is the case with those of the American oaks, which belong to the first section. In those included in the second, on the contrary, the fertile blossom makes its appearance in the axil of the leaves on the new shoot, and remains a whole year without change. In the spring of the second year, after a new shoot has been produced, and new barren and fertile flowers have made their appearance, it is, probably for the first time, fecundated, and then begins to increase, and brings its fruit to maturity eighteen months after its first appearance. In this case, the fruit seems not to be axillary, as the leaves of the previous year, in whose axils it grew, have fallen.

Most of the trees which belong to the first section, possess greater value, on account of the excellent properties of their timber, than those of the second.

FIRST SECTION.

Leaves not mucronate ; fruit supported on footstalks ; fructification annual.

This includes the White Oak, the Swamp White Oak, the Chestnut Oak, the Rock Chestnut Oak, the Over Cup White Oak, the Post Oak, and the Little Chincapin Oak.

SECOND SECTION.

Leaves mucronate ; fruit nearly sessile ; fructification biennial.

Black Oak, Scarlet Oak, Red Oak, and Little Bear Oak.

TABLE OF THE SPECIES.

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|--|---|---|
| 1. | { | Leaves not mucronate. 2. |
| ———— mucronate. 5. | | |
| 2. | { | Leaves lobed. 3. |
| ———— toothed. 4. | | |
| 3. | { | Leaves nearly regular, acorn cup warty. <i>White Oak</i> . 1st. |
| ———— deeply lobed, very irregular, cup fringed. <i>Over cup</i> . 2d. | | |
| ———— ——— upper lobes dilated, star-like, very rough. <i>Post</i> . 3d. | | |
| 4. | { | Leaves wedge-shaped at base, much larger towards the end, with one deep sinus on each side. <i>Swamp White</i> . 4th. |
| | | Leaves nearly regular, long and narrow. <i>Chestnut</i> . 5th. |
| | | ———— larger towards the end, entire, rounded at the extremity. <i>Rock</i> . 6th. |
| | | Leaves larger towards the end, waved or toothed ; a shrub. <i>Chinca-pin</i> . 7th. |
| | | Leaves deeply sinuate, downy beneath ; bark yellow within, very bitter. <i>Black</i> . 8th. |
| 5. | { | Leaves more deeply sinuate, smooth beneath ; bark reddish within, less bitter. <i>Scarlet</i> . 9th. |
| | | Leaves less deeply sinuate, lance-shaped ; cup very broad, scales close. <i>Red</i> . 10th. |
| | | Leaves somewhat lyrate, or 4-or 6-sided ; a shrub. <i>Bear</i> . 11th. |

Sp. 1. THE WHITE OAK. *Quercus alba.* Linn.

Leaves and fruit figured in Michaux; Sylva, Plate 1; the tree, in Loudon's Arboretum; Plate 69. E.

In Audubon's Birds of America, Plate 107, the leaves are figured, with the Canada Jay, and in Plate 147; and leaves, flowers and fruit in the first plate in this volume.

Not a prince,
In all that proud old world beyond the deep,
E'er wore his crown as loftily as he
Wears the green coronal of leaves with which
Thy hand has graced him.—*Bryant's Forest Hymn.*

The white oak rises from many strong roots, which swell out, near the base, above the surface, and penetrate deep and to a great distance beneath. It is two, to four or five feet in diameter. The perpendicular trunk, in most of the trees which are standing in our fields and pastures, is not long. In old forests, it sometimes reaches the height of sixty or eighty feet, and even more. Limbs very large, diverging at a very large but not uniform angle, from a broad, gnarled, massive juncture. Some of them go out horizontally, variously contorted, much and variously branched. The higher limbs make a sharper angle. They all often make considerable bends, in any direction, upwards, downwards, or on either side. Spray of many twigs, at right angles, in all directions, miniatures of the larger limbs. The bark on the trunk is of a very light ash-color, whence it is universally known, and always called the white oak. And it is the only oak which has but one name. The bark naturally breaks into small, irregular, four-sided plates, which often easily scale off. The leaves, on short petioles, are four to six inches long and two or three wide. They are pubescent beneath when young, but smooth when old; the upper surface of a bright, shining green, the lower paler or glaucous, in substance almost coriaceous. They are always deeply divided into lobes, about three or four on each side, which are oblong, rounded or obtuse, rarely subdivided. The leaves differ very much, in different localities. Sometimes the lobes are almost linear, making skeleton leaves. Sometimes the leaves

are perfectly and beautifully regular. These differences mark varieties which, when trees come to be as highly valued and as carefully studied here, as they are in England, will receive names. I have met with many of these varieties which would be worth cultivating for their peculiar beauty. In autumn, the leaves turn to a pleasant purple or violet color, very different from that of most other leaves. Many of these remain on through the winter, making in this tree the nearest approach to the evergreen oaks of warmer climates. The buds are small, short, rounded, and invested with several indistinct scales. The male flowers are on a long and very slender thread, each cup containing from four to seven stamens.

The acorns vary much in size and sweetness, and somewhat in shape. They are usually about an inch long, ovoid, oblong, in a shallow, somewhat flattened, hemispherical cup, of a grayish color, rough externally, with roundish tubercles. They grow single or in pairs, on a footstalk, from half an inch to an inch long, fixed to the years' shoots.

The fruit is seldom abundant, not oftener, it is commonly thought, than once in seven years; and I have looked through an extensive forest of white oaks, at the season when the fruit was to be expected, without finding an acorn. The fruit is eagerly sought for by many wild animals, and is not unpleasant to the taste, especially when roasted.

Michaux says, that he found the white oak as far north as the latitude of $46^{\circ} 20'$; as far south as latitude $28^{\circ} 11'$, and towards the west to the country of the Illinois. We know that it extends much farther to the west. He thinks it more multiplied in the western parts of Virginia and Pennsylvania than in any other parts of the United States. Mr. Douglas considers Lake Winipeg its northern limit, and says, that it attains there a height of ten to twenty feet.

It is found in every part of this State, although very rarely in the western, where its place is taken by the rock maple, and most abundantly, and of the largest size, in Essex County. It grows well on a great variety of soils, but best on a moderately high, moist, loamy soil, particularly in sheltered situations, as on the southern sides of hills. No tree is more affected by the wind

in the early stages of its growth; and it every where seems to shrink from the sea breeze.

The wood of the white oak unites the properties of hardness, toughness, and durability, in a greater degree than any other native wood. It is of a reddish hue, and is very heavy, compact and close-grained. The interval between the circles of growth, is, however, porous, the pores sprinkled with brilliant, resinous-looking points. The plates of silver grain, radiating from the pith, are thicker and more remote from each other than in most woods, and are at very unequal distances. As in the other oaks, they are somewhat sinuous. They are not so thick as those of the live oak, but more so than those of the black. Its specific gravity, according to Bull, is to that of shell-bark hickory, as .855 to 1.

On account of its uses, the white oak is the most valuable of our trees. It is applied to almost every purpose. It furnishes the best ship-timber. It is preferred for the upper and lower floor timbers, for keel, kelson, stem and stern posts and timbers, for lower deck beams, for out-board planks, and for clamps, or the thick stringers on the inside, on which the beams rest. By some it is preferred to locust for treenails.

Carriage and wagon builders use scarcely any thing else for the spokes of wheels. The carriage makers of Boston get it from the towns in the vicinity. It is also used for the fellies and axles, and sometimes for the hubs of wheels, but not in preference to all other materials, and for the frames and runners of sleighs. The ribs, knees, gunwale and ribbons, and the charks and top charks of whale-boats are of white oak. Many agricultural instruments are made of it. The mould-boards and handles of ploughs, and often axe-helves; the body, frames, tongues, and axles of carts.

It is preferred to every other wood, except pitch pine, for pumps. It is used for the very best casks, those intended to contain water, provisions, and all penetrating liquors, and for these purposes it is imported into Boston from Mobile, New Orleans, and other southern ports. It makes the best hoops, with the exception, perhaps, of hickory; both which must be wrought while in a green state.

For the purpose of making baskets, the lower part of the trunk of young white oak trees is very much used, on account of its great elasticity and suppleness, and the evenness with which it may be divided into narrow strips or ribbons, when in that stage of growth. For this purpose, it is worth twenty dollars per cord. The wood of the young tree is also used for ox-bows, where hickory cannot be obtained, and even in some places in preference to it. It is often used for handspikes and levers, and all those numerous purposes in which strength, elasticity, and toughness are required.

The bark is valuable to the tanner. It is nearly like that of the European white oak, which is so highly prized in England and France, that all the small branches are stripped, whenever an oak is felled. In this respect, there is still a great want of economy in most parts of our country. The average value of this bark, near the sea-coast, is about eight dollars per cord.

The root of the white oak is seldom taken up, except for the purpose of making knees for naval architecture. But, judging from the great beauty which a section of these roots sometimes exhibits, they might with advantage be substituted for many of the foreign, imported woods, for ornamental purposes, as for the manufacture of chairs and tables. The great defects of the wood of white oak is its shrinking much and irregularly, which may, however, be obviated by thorough seasoning.

The value of white oak for charcoal is very considerable, being surpassed only by that made from the chestnut, the hickories, and the chestnut white oak. As fuel, it is quite as much prized as it deserves, making at best but a slow fire, and far inferior, for this purpose, to the hickories. Its great importance, as timber, and its increasing scarcity, will, however, prevent its being much used for either of these purposes.

What has been said of the oak as an ornamental tree, applies especially to the white oak. It is beautiful in every stage of its growth; at first, light, slender, delicate and waving; at last, broad, massive, and grand, but always graceful. Let every one who has an opportunity, plant a white oak. When standing in a situation where it is somewhat protected, and has room freely to expand its limbs, it will every year improve in beauty

and magnificence, for a time equal to at least five of the generations of men :—

“Multosque nepotes,
Multa virum volvens durando sæcula vincet.”

When standing together, the mixture of all the various species of the oak, will make a much more beautiful forest than any one alone.

•The great value of this tree has caused the destruction of almost all trunks suitable for timber, so that it is rarely found of a large size. One which I measured in Greenfield, in 1838, was seventeen feet five inches just above the root, and fifteen feet three inches at three feet. A white oak standing nearly opposite Deacon Nurse's, in Bolton, measured, in 1840, nineteen feet, just above the roots, and fourteen feet, at three feet from the ground. It had a fine, fresh, broad head.

The picturesque ruin of a white oak is standing in Brighton, where the road called Nonantum Street crosses that from Boston to Newton Corner. At the surface of the ground, it measures, this first of October, 1845, twenty-five feet and nine inches in circumference; at three feet, it is twenty-two feet four inches; at six feet, fifteen feet two inches. It tapers gradually to the height of about twenty-five feet, where the stump of its ancient top is visible, below which point four or five pretty large branches are thrown out, which rise twenty or thirty feet higher. Below, the places of many former limbs are covered over by immense, gnarled and bossed protuberances. The trunk is hollow at the base, with a large opening on the southwest, through which boys and men may easily enter. It had, probably, passed its prime, centuries before the first English voice was heard on the shores of Massachusetts Bay. It is still clad with abundant foliage, and, if respected as its venerable age deserves, it may stand, an object of admiration, for centuries to come.

Sp. 2. THE OVERCUP WHITE OAK. *Q. macrocarpa*. Michaux.

Leaf and fruit figured in Michaux ; Sylva, I, Plate 4. Leaf and fruit in Plate 2, of this volume.

This oak, as it occurs in Massachusetts, is a fine, erect tree, of medium height, much and irregularly branched, and clad with a most luxuriant foliage. The lower branches are short, horizontal, and bushy; the upper ones tending upwards, but often bending, at sudden angles, in various directions. The aspect of the tree is much like that of the swamp white oak, but the branches are free from the loose bark which often deforms that species. The bark on the trunk is of an ashen color, intermediate between that of the white oak, and of the swamp white oak, less broken than either, with long, superficial ridges or scales. The recent shoots are covered with a yellowish brown, somewhat downy, dotted bark, turning gray the second year, and soon after becoming rough.

The leaves are on short footstalks, pear-shaped in their general outline, very deeply and irregularly sinuate-lobed, with three, four, or five bays near or below the middle, which extend very nearly to the mid-rib; wedge-shaped or rounded below, usually much broader and more entire towards the extremity. They are smooth and of a dark green above, much lighter, cinereous or glaucous, at first downy, finally nearly smooth beneath, six or seven inches long and three or four wide.

The buds are small, compressed and conical. The acorns are very large, and enclosed for more than half their length, in a cup covered with very prominent scales, and bordered by a conspicuous fringe of long, flexible threads. Michaux says that these threads do not appear when the tree is in the midst of a forest, or when the summers are not very warm.

This tree is found in Stockbridge, and the towns below it in Berkshire County, and in the neighboring county of Dutchess, in New York, particularly in Dover, on Ten Mile Creek, a tributary of the Housatonic. As Mr. Oakes has also found it in Vermont, it probably occurs in some of the intermediate towns.

It has not previously been known to occur in Massachusetts. Michaux found it most abundant in Kentucky, Tennessee, and on the Missouri.

It is called pin oak, in Stockbridge and Sheffield, from its use in making wooden pins or treenails, for which purpose it is preferred to every other material. The wood of this oak is very solid and stiff, and approaches, in durability, that of the white oak. It is said to be less elastic and tough than white oak, but more solid and smoother-grained. It is used for the axles, reaches, bolsters, and braces of wagons; for framing timbers, for sills and for floors; and for all the other purposes for which the best oak wood is employed. As fuel, it is preferred to white oak.

The beauty of this tree, the abundance and luxuriance of its foliage, and the extraordinary size of its acorns, recommend it to the landscape gardener; the value of its wood, to the forester.

Sp. 3. POST OAK OR ROUGH OAK. *Quercus stellata*. Willdenow.

Q. obtusiloba. Michaux.

Leaves and fruit figured in Michaux; Sylva, Plate 5; in Abbot's Insects of Georgia, I, Plate 47, and II, 77; also on Plate 3, of this volume.

I have found this oak nowhere in Massachusetts, except on the Elizabeth Islands, where, particularly on Martha's Vineyard, it is very abundant, and is called the rough oak, from the roughness of its leaves. It resembles the white oak, but is distinguished at once by its mode of branching, by the density of its foliage, and by the stiffness and peculiar form of its rough leaves. It there grows rarely above twenty-five or thirty feet high, and eighteen or twenty inches in diameter. The trunk is covered by a rough, hard, grayish-white bark, broken by deep crevices into oblong portions, usually scattered with whitish and black lichens. The branches are numerous, low, at right angles, and very crooked, and being crowded near the base, give the appearance of the top of a tree whose trunk is under ground. The shoots of this year's growth are long and covered with a whitish and downy bark. The leaf-stalks very short. The

stiff, coriaceous leaf is divided, at one-third its length, by a deep sinus on each side; the upper portion is of three broad, obtuse, divergent lobes, often double. The upper surface is dark green, and very rough; the lower, whitish, softer, downy, the mid-rib and nerves turning to a rose color in autumn. The leaves have not unaptly been called stellate, the upper part resembling a star. They are close set, in large bunches or tufts, much more fleshy and close than those of the white oak, and giving greater fullness and depth to the foliage. The spray is larger and thicker. The acorns, nearly sessile or on very short footstalks, are set in a grayish, broad cup, invested by numerous, very smooth, close scales, and are small and sweet. They are single, or two, three, or four together.

In Camden, opposite Philadelphia, where I particularly observed this tree, it is a fine tree of fifty or sixty feet, bearing a broad, massive head, and casting a deep shade.

On Martha's Vineyard, where the tree never grows large, the wood is preferred to all others for fuel. It forms very valuable knees for ship-timber, but is rarely of sufficient size for other purposes. In the Southern States, it is called post oak, and is preferred to all other kinds of wood, on account of its durability, when used as posts. "Its timber is supposed, in strength and durability, to surpass that of any other species of the oak, except the live oak; and, therefore, is highly prized when it can be obtained sufficiently large to be used in the construction of vessels."—(*Elliott.*) Staves made of it are preferred to those of any other material.

Michaux had not found the post oak north of the Hudson, and supposed that its existence as far north as on the western bank of this river, opposite New York, was due only to the influence of the sea-breeze in tempering the severity of the cold. On the Vineyard, it nearly covers a promontory which projects eastwardly of Holmes' Hole into Buzzard's Bay. In the most exposed situations, it is very low and scraggy, forming a sloping wall of close, crooked branches and trunks, towards the sea-breeze. Behind and under cover of this, it rises higher toward the centre of the island, but I think never exceeds thirty feet. In the same exposed situation, the other oaks, particularly the black,

hardly exceeds this in height, whilst, in the centre of this island, the latter becomes a very large and tall tree.

I think the post oak would grow readily in a sheltered situation, in any part of Massachusetts, but it probably would not reach a great height.

It abounds in the western and south-western States; and probably some of the timber imported thence, under the name of white oak, with which it is often confounded, is the produce of this tree.

Sp. 4. THE SWAMP WHITE OAK. *Quercus bicolor*. Willdenow.

Leaves and fruit figured in Michaux; Sylva, I, Plate 7; and in Plate 4, of this volume.

The swamp white oak is found in great numbers in the low moist grounds in the vicinity of Boston, and in every county in the eastern section of the State; and it occurs as far north as York County in Maine. It is distinguished at all seasons by its nearly entire, wedge-shaped leaves, and by its white bark, rough, with large, loose flakes or scales, and its numerous and intricate branches. These begin low down on the trunk, but are seldom of great height. The bark on the smaller, recent branches, is of a light grayish green.

In warm and sheltered situations, it is a neat and beautiful tree. When too much exposed to the east or north wind, it shows the effect by its ragged appearance.

The leaves, when young, are very downy, with a whitish ferruginous down beneath, and of a reddish green above. When mature, they are on short footstalks, three to six, or seven inches long, and two to four broad, acute at base, having often a rather deep bay on each side just below the middle, and usually abruptly dilated towards the end, bordered by a waving line, forming about thirteen large teeth, mostly obtuse, but sometimes ending in a callous point. The edge is slightly folded back smooth, and of a pleasant green above, and covered beneath with a white, very soft down; nerves and larger veins prominent, and rust-colored. Below the large leaves are commonly

found smaller ones, with four or five teeth, or perfectly entire. The leaves, in fading, become of a light, leather yellow.

The buds are short, roundish, and obtuse. In May, the male blossoms appear in great numbers, on threads two or three inches long, from the base of the new shoots, or from lower buds, which produce them only. There are about four stamens in each flower. In the axil of the tender, just expanding leaves, the female blossom appears, single or in twos, on a footstalk of half or two-thirds of an inch in length.

The footstalk lengthens, late in the season, to two or three inches, and bears one or two very broad, roundish-ovate, pointed acorns, in deep, broad, hemispherical cups, rough, and sometimes ragged and mossy without, with the projecting points of the scales, from whose union the cup is formed.

The fruit is sweet, not abundant, but more so usually than that of the white oak.

There are many varieties of this tree, differing strikingly in the smoothness of the bark, in the shape of the leaves, sometimes narrow and somewhat deeply lobed, in the roughness of the acorn cup, and the character of the branches. They are not often handsome, usually offending the eye with the roughness and scaliness of the bark, and the scragginess of the branches. But there are exceptions; and some of the varieties are fine, shapely trees.

The wood of the swamp white oak is of a brownish color, heavy, compact, and fine-grained, and possesses great strength and elasticity. It approaches in value to that of the white oak. By boat-builders it is sometimes preferred. It seems to have, in an inferior degree, the properties which distinguish that wood, and forms an excellent substitute. It has considerable toughness, so that hubs are sometimes made of it.

This tree grows to a large size. I have seen stumps which measured five feet and more in diameter. But I have not measured many large trees. One, a third part of a mile from the great elm, on the land of Mr. Jaquith, Newbury, growing in a wet, clayey soil, measured, in 1839, twelve feet and one inch in circumference, at four feet from the ground.

Sp. 5. THE CHESTNUT OAK. *Quercus castanea*. Muhlenberg.

Leaves and fruit figured in Michaux ; Sylva, Plate 10, and in Plate 5, of this volume.

This graceful tree is distinguished from the rock chestnut oak, by its narrower leaves, more nearly resembling those of the chestnut tree, and having sharper teeth, and by its smaller fruit.

I have found only a few straggling individuals, and at first took them for varieties of the tree last mentioned. I was struck with their beauty, but I have been able to learn nothing in regard to the peculiar qualities of the wood as fuel, or as timber, or of the bark, as it is, wherever found, confounded with the rock chestnut oak, and, together with that, known by the name of chestnut oak. Several trees of this group are, in all the States where they grow, confounded with each other by the common people. And the elder Michaux, who viewed them with the discrimination of a botanist, and with a wealth of observation which could afford not to multiply species, considered them as varieties of the one species, *Prinus*. The younger Michaux makes this a distinct species, and points out some striking peculiarities. He says that the wood is of a very yellow color, that it grows only in fertile valleys, and that its bark separates in sheets, like that of the swamp white oak. The texture of the wood also differs in having more numerous, and irregularly disposed flakes of silver grain, than in any of the other oaks. Whoever has been in the habit of examining many trees and varieties of wood, will be willing to admit that these differences are not greater than we meet with in trees acknowledged to be of the same species. These trees must be raised, side by side, from seed, before we can be sure of their essential distinction.

The younger Michaux considered the banks of the Delaware as the northeastern limit of this oak, which he found most abundant in some parts of Pennsylvania and Tennessee. I have found it growing about Mount Agamenticus, and, farther north, on the banks of the Saco River, in York County, Maine. In this State, I have found it in Lancaster, Sterling, Russell, and Middleborough.

Sp. 6. THE ROCK CHESTNUT OAK. *Quercus montana*. Willdenow.

Figured in Audubon's Birds, Plate 131; leaves and fruit figured in Abbot's Insects of Georgia, II, Plate 82; in Michaux; Sylva, Plate 9; and in this volume, Plate 6.

This oak is by no means frequent in the State, and where found, it is usually confined to small districts on rocky hills. It is called sometimes the rock oak, or, more frequently, the chestnut oak, and has great resemblance to the chestnut tree in its general appearance and mode of growth. I have found large forests of it in South Attleboro', small patches in Middleboro', in Sterling and Lancaster, larger ones in Erving's Grant, and that neighborhood, and detached clumps in various places in the hill country, on both sides of Connecticut River. It is found in New Hampshire and Vermont, and is abundant on the Alleghany Mountains.

I have never found it growing to a large size, but usually between one and two feet in diameter, and forty to sixty feet high. One in Sterling measured six feet two inches, at three feet from the ground. The trunk is covered with a dark, reddish-gray bark, often spotted with whitish lichens. The bark is somewhat lighter than that of the chestnut tree, and less rough than that of most other oaks, resembling that of the red oak, but smoother. The clefts are long, but not deep, and near each other, and rather smooth on their sides. The branches are not very numerous, making a sharper angle than in the oaks above-mentioned; and the ultimate divisions are very small. The bark is very compact.

The leaves vary considerably in size and shape,—being from four to nine inches long, and two to five wide. They are borne on very short footstalks, obtuse and often unequal at base, sometimes broadest at the middle, but more frequently towards the extremity, with from six to thirteen large, rounded teeth on each side, which often end in a small hard point, the termination of the parallel nerves, which are connected by finely reticulated, parallel veins; they are of a polished green above, much lighter, and, in a young state, downy beneath.

When the trees are cut young, the stumps throw up shoots, of four feet or more in length, the first year.

This beautiful tree has many claims to attention. It is, according to the uniform testimony of those who have tried it as fuel, superior, for that purpose, to any other oak which will grow in the same situation, and it is generally considered superior to every other wood. Mr. Bull's experiments would lead to a different conclusion, as he makes its value less than that of most other oaks.

As timber, it ranks, with many, next to the white oak. It is doubtless very valuable, but not more so than either of the preceding oaks.

The bark, wherever it has been used, is highly esteemed by tanners.

The acorns, which it produces as scantily and as rarely as either of the preceding, are large and very sweet.

But the chief recommendation of the rock chestnut oak, is the situation in which it grows. It grows naturally and flourishes on the steep sides of rocky hills, where few other trees thrive, and where the other kinds of oak can hardly get a foothold. There are, probably, thousands of acres of hilly, rocky land, in almost every county in Massachusetts, where various kinds of evergreens have grown, unmixed with deciduous trees, until they have exhausted all the nutriment suited to their support, and where now, consequently, nothing thrives, which would furnish abundant support for this kind of oak.

It is well known, that successive growths of trees of the same family exhaust the soil, in the same manner as successive crops of annual or other herbaceous plants of the same kind. And they not only exhaust it, but are supposed to fill it with excrementitious matter, which is in a manner poisonous to analogous plants. The remedy, in cultivated lands, is a rotation of crops. The same suggests itself in the forest; and, whenever it can take place, a rotation is established by nature. But where no seed, of a kind entirely unlike that which has grown upon the soil, is found, unassisted, nature cannot supply the want. In such cases, the art of man may come in with advantage. There is every reason to believe, that if acorns of the oak of which

we are speaking, were planted on many hills, which now bear nothing but stunted cedars, they would meet with the soil they want, and would flourish exceedingly well.

Sp. 7. THE LITTLE CHINCAPIN OAK. *Quercus chinquapin*.
Michaux.

Leaves and fruit figured in Michaux ; Sylva, Plate 11.

This is much the smallest of the oak family which occurs in New England, seldom rising above five feet, and usually only two or three. It is found, scattered in almost every part of the State. On Martha's Vineyard, it occupies, in some instances, many acres together, to the exclusion of almost every thing else. It is also abundant in some parts of Middlesex County. I have found it and the bear oak, chiefly, but not exclusively, on sterile soil. It produces great quantities of acorns, which seem to be devoured with avidity by wild animals, and also by cattle and swine.

The recent shoots are of an olive or bronze green, smooth and shining, channelled, and dotted with small orange or yellow dots. The larger branches are of a light, shining, ashen gray ; the stem dark, almost black, clouded often with light patches of membranaceous lichens. The fruit is borne on footstalks of half an inch in length, from the axils of the leaves about the middle of the recent shoots. The cup is often set with several abortive acorns, which fall off when about one-fourth of an inch long. The leaves are obovate, tapering gradually to a petiole one-half to one inch long ; they are obtusely pointed, sometimes nearly entire and sinuate on the border, usually with four to eight large teeth on each side, which terminate in a blunt, brownish, callous point ; margin slightly revolute ; surface light green and polished above, whitish or bluish, fine-downy beneath.

The bitterness of the bark shows that it abounds in tannin ; and it might, doubtless, be advantageously used by the tanner, as the small branches of most of the oaks are in Europe.

Where this little oak constitutes the principal growth, it might easily be made to perform an important service. If the

seeds of the pitch pine, the red cedar, the larch, or some of the valuable oaks, were placed, at the right season, an inch or less beneath the surface of the soil,—they would spring up under its shade, and be protected by it from sun and wind, until they were large enough to need no further protection; after which it might be grubbed up, or left to die gradually in the shade.

Sp. 8. THE BLACK OR YELLOW-BARKED OAK. *Quercus tinctoria*.
Bartram.

Leaf figured in Michaux; Sylva, Plate 24; fruit, Plate 25. One variety is figured in Abbot's Insects of Georgia, II, Plate 56. By A. Michaux; Histoire des Chênes, Plates 24, 25; and poorly in Audubon's Birds, Plate 82; the two most common forms are figured in Plates 7 and 8 of this volume.

This oak is distinguished from all others, by the rich yellow or orange color of its inner bark, and the same color, less deep, in the fruit. It is, usually, also remarkable for the black color of the external bark on the lower part of the trunk. But this characteristic often fails in young trees; the two oaks which follow being often dark in almost an equal degree.

The trunk, even in rather small trees, is excessively rough towards the base. In old trees, this extreme ruggedness extends throughout the trunk, and the bark is always remarkably free from the larger lichens.

The recent branchlets are brownish, or bronze red, somewhat channelled, and usually downy, closely dotted with minute gray dots,—with brilliant black dots, when seen under a magnifier. The older branchlets are of a grayish or pearly green, dots not much enlarged, surface soon clouded with pearly, membranaceous lichens. The buds are large, ovate, or pyramidal, reddish brown, or grayish, and pointed.

The staminate flowers are on a long pendulous thread, closely covered with down. Perianth downy, deeply divided into two to four fringed pieces; stamens four to six; anthers opening on the sides, to the base.

The fertile flowers nearly sessile, one, two, or three together, in the axil of a leaf; cup formed of several fleshy scales, the outer ones narrow and pointed, the inner, broader; styles three,

diverging, bearing recurved stigmas, issuing from an ovary which is surrounded by the fringed points of four to six segments of a perianth, all densely covered with down.

The acorn is small, of a flattened, globose shape, sometimes beautifully striped with longitudinal bars of yellow and brown, in a very deep cup, of a brilliant orange within, lengthened downwards and gradually diminishing. The scales are free at their extremities, near the acorn, and waving. The kernel is of a yellowish or faint orange color, and very bitter.

The leaves are borne on long, rather slender, usually downy footstalks, inclined to yellowish green. They are inversely egg-shaped in their general outline, obtuse and unequal, rarely acute at base; on old trees, deeply cut by about three sinuosities on each side; on young and vigorous shoots, particularly on sprouts from a stump, more nearly entire. The lobes are usually broader, and the sinuosities less deep than in the scarlet oak. The lobes often enlarge towards the extremities, rendering the sinuses somewhat ovate: the primary and secondary veins end commonly in bristles. The surface is often dusty with a fine down above, still shining, and sometimes, in old leaves, smooth; beneath, downy, when young; smooth, or nearly smooth, when old, except at the axils of the veins, which are almost always downy. The color is usually much darker than that of the leaves of the scarlet oak, and the texture is thicker. They are often spread beneath with a ferruginous down, accumulated at the axils of the veins.* Late in autumn, the leaves become of a rich, yellowish brown, or russet, or russet-orange.

There are three pretty distinct varieties of the black oak. The first has its leaves full and almost entire, and running down along the footstalk; the second has leaves almost exactly

* Those figured by the elder Michaux are precisely such as can be always found on the young, lower, vigorous sprouts of the black oak. Pursh, Nuttall and Beck fall into the mistake, while evidently speaking of this same tree, of describing its leaves as not deeply lobed. Pursh says, "*levissime sinuatis*." Now, leaves of this shape can always be found, and are characteristic of this tree. But the greater part of the leaves, on old trees, are very deeply lobed, almost as much so as those of the scarlet oak, and much more than the leaves of the red oak.

resembling those of the scarlet oak, from which it cannot easily be distinguished but by the color of its inner bark. The third has leaves very broad at the extremity, and tapering much towards the base. These trees seem to be as different as the several varieties or species of the chestnut oak group. There are, probably, corresponding differences in the qualities of the wood.

For ship-timber, the wood of the black oak is next in value to that of the oaks of the first division; and it is much used as a substitute for white oak. For floors and floor-timbers, it answers well, but is liable to decay, about iron. The grain is close and rather fine; the pores between the circles of growth are not large; the plates of silver grain rather wide and near together. It has, therefore, great strength, and is extensively used by wagon-makers and other manufacturers in wood, being, for some purposes, superior to white oak.

The bark is highly valued by the tanner, as it abounds in tannin. It is liable, however, to the objection, that it gives a yellow color to leather, which is communicated to articles which remain long in contact with it.

The bark is also much used in domestic manufactures, for dyeing. With various preparations, it gives a great variety of shades of fawn color and yellow. From the inner portion of the bark is obtained the substance called quercitron, which was first brought to notice by Dr. Bancroft, and is used as a substitute for weld, in dyeing on a large scale. The colors given are fast colors. By a mixture of other dyes, as cochineal, several other shades, all rich and delicate, are given by quercitron.

This bark is not so highly valued as it should be. By means of it and the sumac, alders, birch, and some other barks, nearly all the colors necessary in dyeing might be obtained without cost, as the time of those who would prepare it is not commonly applied to any productive object, at the season when the preparation might be made.

Upon the leaves of the black oak, as also those of the red and scarlet, are often found smooth, round, light excrescences, called oak apples, one or two inches in diameter. They are formed by an extension of the cuticle of the leaf, which they

resemble in color and consistency, enclosing a portion of fibrous, fleshy substance. This gradually shrinks to a brown, spongy mass, with a small woody kernel in the centre, and a thin, brittle, drab-colored shell. They are produced by an insect puncturing the healthy leaf, and depositing therein an egg, about which the apple forms. "A single grub lives in the kernel, becomes a chrysalis in the autumn, when the oak apple falls from the tree; changes to a fly in the spring, and makes its escape out of a small round hole, which it gnaws through the kernel and shell. . . . The name of this insect is *Cynips confluentus*."*

The black oak, far the most valuable of its group, is found in the southern part of Maine and in New Hampshire, and is more abundant in the eastern part of Massachusetts than any other oak, except the white and the scarlet. From the latter it is not usually distinguished, while standing, except by ship-builders. When felled, it is known by its thicker bark. It does not often attain a large size, being seldom found over four feet in diameter, and from forty to sixty feet high. In the Middle and Western States, it rises to the height of eighty or ninety feet, with a diameter of five feet or more. It is of a rapid growth, and flourishes even on poor soils.

A yellow bark oak, in Sterling, on a rocky hill on the lands of Mr. Stewart, measured, at the ground, thirteen feet in circumference; at three feet, nine; at six, eight feet one inch. It rises at least thirty feet in a straight, undivided column, without a limb and with a gradual taper. It then begins to branch, and terminates at a goodly height, in a roundish head of few branches.

Sp. 9. THE SCARLET OAK. *Quercus coccinea*. Wangenheim.

The fruit is figured in Michaux; Sylva, Plate 24; leaves on Plate 25; leaves and fruit on Plate 9, of this volume.

This handsome tree is almost every where known by the name of the red oak, and is thence confounded with a tree which is inferior to it in every valuable property. The trunk

* Harris's Report, p. 397.

is straight, rather rapidly, but not abruptly diminishing. The bark on small trees is of a reddish granite color, rough, with numerous short clefts; on older trees the bark has a bluish tinge, whereby it may be distinguished from that of the black oak. The recent branchlets are of a light purplish green, very smooth, older ones darker, purplish green; larger branches grayish.

The flowers appear in May; the sterile on a slender green thread, two or three inches long, set with a few scattered hairs. The perianth is brown, on a very short footstalk, single, deeply divided into four to six jagged, unequal, fringed lobes. The stamens are five, (four to six,) on filaments longer than the perianth, and a little hairy above and below.

The acorn is small, of a lengthened globose form, in a deep cup considerably prolonged at base, the upper edge of which is very abrupt, and the scales rather large, not free, but usually close at the edge of the cup, and hairy on the side edges. The kernel is white, and less bitter than that of the black oak.

The leaves are on long, slender, smooth petioles, irregular in shape, but oblong or roundish in the general outline, very deeply sinuate, with about three broad, rounded sinuosities; lobes long, acute-angled, or with their sides nearly parallel, ending in a bristle; thin and very smooth, and polished on both surfaces, except that they sometimes have a slight pubescence at the angles of the veins beneath. The leaves are commonly inequilateral and obtuse at base, though sometimes acute, and end in an oblong, narrow lobe, partially divided into three parts.

This tree may be usually distinguished from the black oak, at a little distance, by its more deeply cut foliage, and consequently lighter appearance, and also by the brighter and lighter hue of the leaves, and the brilliancy of the points of reflected sunlight. Yet, from the general similarity of the two, and the numerous varieties of each species, an inexperienced observer is very apt to imagine that he finds both, in a forest made up exclusively of either; and it must be admitted, that they often approach so near each other in character, that it is exceedingly difficult to distinguish them without cutting into the bark, except after the change in the color of the foliage, which takes place in

autumn. The rich and beautiful deep scarlet color, red dotted with crimson, or orange scarlet, of the foliage of this oak, separates it strikingly, at that season, from every other species.

To obviate the difficulty of discrimination, I have brought together the points of difference, by which they may be distinguished from each other, at any age or season.

In the black oak, the leaves are broader and fuller towards the end; larger, more nearly entire, and usually darker and thicker; on small plants they are more full and more nearly entire; the footstalk is stouter; the axils of the veins are very downy; and the leaf is more fully covered with down, on both surfaces, when young. The buds are larger, grayish, and downy; the young branches and shoots stouter; the acorn cup has the upper edge of the scales next the acorn loose and fringed. The stem of the tree is blacker, particularly towards the base, rougher, with chinks numerous, and black within; and the old bark not so fully covered with lichens. The kernel of the acorn, the inside of the acorn cup, and the inner portions of the bark, are of a rich orange color, and all intensely bitter.

In the scarlet oak, growing in the same forests, the leaves are fuller towards the middle, smaller, thinner, more deeply cut, and of a lighter and livelier color; on small plants, more deeply cut, but sometimes running down along the footstalk; the footstalk is longer and more slender, and both surfaces and the axils of the veins are always less downy. Young branches and shoots more slender and smooth; buds smaller, conical, obtusely pointed, brownish, smooth; in the acorn cup the extremity of the scales closer, and not forming so much of a fringe next the acorn. The stem is gray, with a bluish tinge, and less rough; chinks less numerous, light brownish within; the old bark, where smooth, covered with lichens. The kernel of the acorn and inside of the acorn cup, are white or pale yellow; inner portions of the bark reddish; all much less bitter.

The scarlet oak abounds in the eastern part of the State, forming a considerable portion of the oak forests in Plymouth and Bristol counties, and in the vicinity of Boston,—for thirty or forty miles on every side. It is found, also, but far less

abundantly, in the middle of the State, and in the river counties, but seldom occurs westward of the Connecticut.

As fuel, it is not commonly distinguished from the black oak, to which it is, however, decidedly inferior. It forms a large part of the wood which is imported into Boston from the south shore, or which is brought in from the neighborhood.

For the use of the tanner, it is still less valuable; the bark being much thinner than the yellow oak bark, and less abounding in tannin. It is, however, far superior to the bark of the red oak, with which it is constantly confounded, from having, in many places, the same name.

The scarlet oak, like the black, is a tree of considerable beauty at every season of the year. But in the autumn, when the whole forest has changed its color, the rich scarlet which its leaves assume, makes it an object of conspicuous beauty. The leaves, after they have undergone this change of color, which has no dependence on the action of the frost, remain long upon the tree, and, in the natural forest, blend harmoniously with the dark brown of the red, the yellow of the old black oak, and the red hues of the young, and the deep rich purple of the still more persistent leaves of the white oak. Adding to these the various shades of crimson and orange of the maples and tupelos, you give to a stroll through the autumn woods in a pleasant day in the Indian summer, such a variety of attractions, that he who yields to them, and comes out to enjoy the scenery with its rich, mellow colors, and the soft, mild and yet glowing atmosphere, each so made for the other, finds it difficult to persuade himself how so many can be induced to forego the enjoyment.

Neither the scarlet nor the black oak grows to a great size or height in Massachusetts, though in the Middle, Southern, and Western States, they are among the tallest oaks. I have not found many over five feet in diameter. One, in Natick, near Mr. Jonathan Bacon's, measured sixteen feet four inches in circumference at the ground, but diminished rapidly, being only ten feet, at four feet above. The scarlet has less of the tendency to spread than most other oaks, but is a graceful tree, presenting in its shape and limbs an endless variety of beauty.

Sp. 10. THE RED OAK. *Quercus rubra*. L.

Figured very poorly in Abbot's *Insects of Georgia*, II, Plate 103;* well in Michaux; *Sylva*, I, Plate 28. The prevailing character of the leaves, at the north, is given in Plate 26: also figured in Plate 10 of this volume.

The red oak is the most northern of the oaks. According to Dr. Richardson, it is found as far north as the Saskatchewan, and the rocks at Lake Namakeen. It is common in all the New England, Middle, and Southern States, as far as Georgia, and on the western declivities of the Alleghanies. Like the elm, it comes to its greatest perfection in Massachusetts, perceptibly diminishing in vigor and luxuriance of growth, farther towards the north, and not increasing in either towards the south. This tree is found in every part of Massachusetts, growing freely in every variety of soil, even the poorest. It is known by several names, the red, the black, and the gray oak. The most general, as the most appropriate name, is the red oak, as the mid-rib and veins of the leaves are often of a rich red color in the latter part of autumn; and the leaves turn to a uniform dark red before they fall.

The trunk is of a dark greenish ashen grey, continuing smooth longer than any other tree of the genus, and never becoming extremely rough. The bark on the recent branchlets is of a polished brown with minute dots; during the next year it has a pearly hue which it exchanges for a deep green, gradually turning to the uniform, greenish gray of the trunk.

The leaves are oblong or lance-shaped in their general outline, larger towards the end, and contracted towards the base. The lobes are five or six on each side, separated by a rounded, not very deep, sinus; the lobes sharp and terminating in bristles. The leaf is obtuse or, more commonly, acute at base; the

* The acorns in this figure show that the red oak is intended; the leaves are very poorly done. The 14th plate in Abbot's work was probably intended to represent the scarlet oak, certainly not *Quercus rubra*, as Sir J. E. Smith supposed it to be. The 56th is evidently the figure of a variety of the *Quercus tinctoria*, (*Quercus tinctoria sinuosa*), as the elder Michaux considered it. Abbot's plate 50 represents, probably, the leaves of the black jack oak, *Quercus nigra* of Willdenow; possibly those of *Quercus aquatica*; certainly not those of *Quercus rubra*.

texture thin and membranaceous; the color of a lively, shining green above, paler, but shining beneath.

The acorns are larger and contained in a broader and shallower cup, than those of any other northern oak. The cup is invested with narrow, thin, and very close scales. The kernel is whitish, and bitter to the taste, but the acorns are eagerly sought after by cattle and swine, though they seem not to be much in request with the smaller wild animals.

The red oak is of little value for fuel or for most purposes as timber. The sour and acrid juices, which can hardly be expelled from the wood by natural or artificial seasoning, rapidly corrode iron spikes which are driven into it; and the bark is almost worthless for the use of the tanner. Beams made of it, and employed in the frame of buildings, have, indeed, been found free from decay at the end of a century; and it is easily distinguished, even at that age, from the wood of any other oak, by its not having become seasoned, and by its thence imperfect combustibility. From having names given it which belong to far more valuable species, it has, in many places, a better reputation than it deserves. It is used, and that only for inferior purposes, where no other species of oak can be obtained.

But, like some individuals in a higher field in creation, it compensates in some measure for its comparative uselessness, by its great beauty. No other oak flourishes so readily in every situation; no other is of so rapid growth; no other surpasses it in beauty of foliage and of trunk; no oak attains, in this climate, to more magnificent dimensions; no tree, except the white oak, gives us so noble an idea of strength.

A red oak, in Lancaster, at the foot of George's Hill, west of the north branch of the Nashua, measured, in 1840, seventeen feet in circumference, at three feet from the ground, and fourteen feet ten inches, at six. A wall prevented its being measured at the surface, where it is much larger. It continues very large for eighteen or twenty feet, when it divides into four or five very large limbs, which spread and form a fine round head. I have found many other large trees.

It is of singularly rapid growth from the stump, the shoots rising sometimes to six feet or more in one season. Careful

measurements of a great number of trees recently felled, show that, for the first thirty-five years, this tree increases at the rate of about two inches in diameter, every eleven years.

Next to the red oak the younger Michaux placed the gray oak, which, however, after a vast deal of examination, I am obliged to consider as only that form of the red oak, which most usually occurs throughout the New England States. The leaf which he has figured for that of the gray oak, is by far the most common form of the leaf of the red oak, on all young and growing trees. The fruit is such as is often found on the red oak, the cup varying on different trees, by imperceptible gradations, from a shape shallower and broader than that he has figured for the red oak, to one narrower than that he has given to the gray oak.

Sp. 11. THE BEAR OAK. *Quercus ilicifolia*. Willdenow.

Figured in Michaux ; Sylva, I, Plate 21 ; and in Plate 11 of this volume.

This little oak is found on poor soils in every part of Massachusetts. It is commonly known by the name of the scrub oak, or dwarf red oak, and sometimes bear oak, from the fondness of bears for its fruit. It is usually not more than six or eight feet high, and an inch or two in diameter, but sometimes attains the height of fifteen or eighteen feet, and the diameter of eight or nine inches. It is covered with numerous large, scraggy branches, with small branchlets.

The recent branchlets are of a light ashen gray, greenish, or of a clouded brown, with a velvet-downy surface. Older ones, greenish, dotted with gray. Stem, a rich green, with numerous dots, and occasionally light clouds, and a transparent, pearly, shining epidermis, growing darker when old, covered in patches, and often completely covered, like other smooth-barked trees, with lichens of various colors, usually dark, or nearly white.

From the axil of the lower leaves on the newly formed shoots, rise, on short footstalks, next year's fruits, two or three together, crowned with their three stigmas.

The leaves are on short petioles, wedge-shaped at base, obovate, somewhat lyre-shaped, with two or three obtuse sinuses

on each side, the larger ones below the middle of the leaf, the lobes ending in a bristle, or often entire, four or five-angled, as broad as long; of a deep shiny green color and smooth above, whitish or ashen-downy beneath, the down abundant in the axils of the veins.

The leaves are about two and one-half inches long, and one and one-quarter or one and one-half broad, on petioles often very short, often one-half or three-fourths the length of the leaf.

The acorns are often beautifully striped longitudinally. The base of the acorn, where it is attached to the cup, is of a deep orange, as is the kernel.

The sterile flowers are in thread-like catkins, one to two inches long, on the base of the recent shoots, or scattered profusely along last year's shoot, in the axils of last year's leaves.

Thread downy; calyx hairy; segments rounded or torn; stamens four, on short filaments.

Fertile flowers in the axil of the recent leaves, nearly sessile; perianth downy; the three stigmas prominent, divergent.

Leaf-stalks, under surface of the leaves and recent shoots, covered with a soft, grayish down.

The bear oak is generally considered of very little value, and is often regarded as a nuisance. It might, doubtless, be turned to some advantage. It grows readily in the most exposed situations and poorest soils, and produces a great abundance of fruit. Michaux suggests that it might be usefully employed as a hedge, by being sown in three parallel rows, ten or twelve inches apart. The plants would soon attain sufficient height and strength to serve as a barrier against cattle, and would be an agreeable object to the eye. It might also be employed to perform the office which it often performs in nature, that of protecting the young of more valuable trees, in the manner which has already been suggested in the description of the little chin-capin oak.

The oaks found in New England naturally arrange themselves in four groups, in the order, as far as I understand their character, in which I have described them. To the first belongs the white oak, which is most nearly allied to the two varieties

as the Continental botanists consider them, of the European white oak. Next to the white oak, are to be arranged, at nearly equal distances about it, the over cup, the post and the swamp white oak, forming a second group, with qualities very nearly equal to those of the first. Of these, the last is most remote, and connects them with the chestnut oak group, to which the elder Michaux considered it as belonging. This third group includes the chestnut oak, the rock chestnut, and the chinca-pin, with the chestnut white oak of a region further south. All these slide, by almost imperceptible gradations, into each other. The fourth group, entirely distinct, includes the black, the scarlet, the red and the bear oak, so nearly allied as to be generally considered the "red oaks;" and in many places this single name includes them all.

ON PLANTING WITH OAKS.

THE value of oak timber is already so great, and it is so constantly and surely increasing, from the diminution of the home supply and the increased difficulty of getting it from abroad, all the kinds of oak, are, moreover, of so slow growth, and the number of years necessary to create a forest so very great, and dependence on a foreign supply is so unsafe, that it is obviously important that means should be immediately taken to convert into future forests some of the many thousand acres susceptible of this, which are now lying waste.

I shall, therefore, make no apology for giving a brief account of the means which have been most successfully used in England and on the continent of Europe, for the forming of oak forests.

In Britain, innumerable experiments have been tried, ever since the days of Evelyn. For the details of these, I must refer to the many publications on the subject which have been made in that country, particularly to London's Arboretum, which gives a historical view of all the most important ones:—

"Artificial shelter," says Loudon, (*Arb.*, IV, p. 1800,) "it is allowed by almost all writers on the culture of the oak, is essentially necessary to ensure the rapid progress of a young planta-

tion. This arises from the natural tenderness of the young shoots and early leaves of the oak, which, even in the south of England, are frequently destroyed or much injured by frost in May; while, in elevated situations, it is found that even the bark does not so easily separate from the wood of standing trees after a cold night. Modern planters seem to be all agreed, that the best mode of producing shelter for the oak is, by first covering the surface with the Scotch pine, larch, or birch; the first being greatly preferred. After the nurse-trees have grown to the height of four or five feet, openings should be cut in the plantations thus formed, at the rate of from three hundred to five hundred according to some, and of sixty to one hundred according to others, to the acre; and in each of these openings an acorn, or an oak plant should be inserted, the soil having been duly prepared."

Young oaks are frequently injured by late frosts in all the lower parts of Massachusetts, and the precautions directed above must be not less necessary in our climate than in the comparatively mild one of England. Instead of the plants recommended by Loudon as nurses, our pitch pine, hachmatack, and black, yellow or white birches, might be used, all of which spring readily from seed.

"The patches are prepared by digging and manuring with lime; and each is planted with five acorns, one in the centre and four around it. After two years' growth, all the plants are removed but one, by cutting through their roots, two inches or three inches below the ground, with a sharp chisel-like instrument with a long handle, made on purpose; the plants removed not being intended to be replanted. As soon as the nurses overshadow the oaks, the plants that do so, or their branches, are to be removed; but 'all the Scotch pines and larches that will require to be taken out before they are sixteen years old,' Mr. Cruickshank says, 'will not render the plantation thinner than a thriving one of the same kind of trees would, for its own sake, need to be at twenty years after planting.'" When the oaks are five years old, they are to be pruned for the first time, by cutting off the lower tier of branches close to the stem; and this operation is to be repeated every two years,

till the oaks are between thirty and forty years old. 'Two thousand of the Scotch pines and larches,' Cruickshank adds, 'may be allowed to remain, not only without injury, but with advantage, to the oaks, till they are sixteen years old.' Half of them may then be cut down, one half of the remaining one thousand at twenty-five years old, and the remaining five hundred at from thirty to thirty-five years old. 'To plant nurses, therefore, is attended with very great pecuniary advantage. It will not only return the whole expense laid out in making the plantation, but produce a very high rent for the land during the first thirty or thirty-five years; whereas, if oaks alone were planted, nothing could be gained during this period, except by cutting them down when between twenty and twenty-five years old, for the sake of their bark.'—*Arb.*, p. 1801, 1802.

When the new plantations in the royal forests, (now exceeding forty thousand acres,) were begun, the most skilful and experienced planters of oaks, in all parts of the kingdom, were consulted, as to the best modes of planting, and particularly in reference to the use of Scotch pines as nurses. Very various and somewhat discordant opinions were given, and, in consequence, several different methods were pursued, and with various success.

"For several years past," according to Alexander Milne, (*Loudon*, p. 1803,) the plan pursued at the New Forest "is to plant the enclosures with Scotch pines only, as soon as they are fenced in and drained (if draining is required); and when the pines have got to the height of five or six feet, which they will do in as many years, then to put in good strong oak plants of about four or five years' growth, among the pines, not cutting away any pines at first, unless they happen to be so strong and thick as to overshadow the oaks. In about two years it becomes necessary to shred the branches of the pines, to give light and air to the oaks; and, in about two or three more years to begin gradually to remove the pines altogether, taking out a certain number each year, so that, at the end of twenty or twenty-five years, not a single Scotch pine shall be left; although, for the first ten or twelve years, the plantation may have appeared to contain nothing else but pines. The advan-

tage of this mode of planting has been found to be, that the pines dry and ameliorate the soil, destroying the coarse grass and brambles which frequently choke and injure oaks; and that no mending over is necessary, as scarcely an oak so planted is found to fail. It is not an expensive method of planting, especially if the plants are raised on the spot."

Instead of the Scotch pine, our pitch pine, which very nearly resembles it, might, as already recommended, be employed as a nurse to the oaks. The seeds of the pine can be procured in any quantities, they easily vegetate, and as they are of a family entirely remote from the oaks, their growth has no tendency to deprive the soil of any essential nutriment.

In many cases, the young pine woods already exist, and it would be only necessary to sow the acorns or set the young plants among them. As has just been seen, the latter method has been preferred in England, where labor is much less expensive than here, and timber is so much more valuable, that it is of great importance to save some years in the growth of the trees, as is supposed to be done by the planting of young trees. But, in consequence of the great cost of labor in this country, it would be desirable to sow the acorns where the trees are to stand, if any way could be contrived to defend them from mice and squirrels; and this might probably be done by sowing a sufficient quantity to allow for the destruction which would be caused by these animals. And there are many arboriculturists, even in England, who prefer to sow the acorn where the tree is to remain.

As to the management of the acorn, the following extract from London will give the most approved mode:—"the acorns need not to be gathered from the tree, but may be collected from the ground immediately after they have dropped; and, as in the case of other tree seeds, they may be either sown then, or kept till the following spring. If they are to be kept, they should be made perfectly dry in the sun, or in an airy shed, mixed with dry sand, in the proportion of three bushels of sand to one bushel of acorns, or with dry moss; and then excluded from the air and vermin, by being put into barrels or boxes, or laid up in a cellar, or buried in heaps, and covered with a suffi-

cient thickness of earth to exclude the weather. If the acorns are to be transported from one country to another, the same mixing with dry sand or dry moss, and exclusion from the air, is adopted; but the more certain mode of retaining the vital principle in acorns is, to mix them with moist earth, or with moist live moss (*Sphágnum*): in either of the latter mediums, they will germinate during a long voyage; but no evil will result from this, provided they are sown immediately on their arrival. When acorns are to be sown in a nursery, the soil ought to be thoroughly prepared and rendered fine; and, after the earth is drawn off the beds, or the drills opened, the acorns may either be scattered over the beds, or along the drills, so that the nuts may be about two inches apart; and, to regulate this distance with greater certainty, the sand may be separated from the acorns with a sieve. In either case, the acorns, before covering, must be patted down with the back of a spade in the beds, and with the back of a wooden-headed rake in the drills. The covering, which ought to be of well-broken soil, should vary in depth, according to the size of the acorn; one and one-half inches being enough for those of the largest size, and one half inch for those of the smallest size. No mode of depositing acorns in the soil can be worse than that of dropping them in holes."

It is often asked why young trees, generally, and oaks in particular, when imported from the nurseries in England, succeed more certainly and grow more rapidly than similar plants taken from woods or open grounds in the neighborhood. One reason probably is, that all the oaks throw down a long tap-root, and for the first few years have very few lateral fibres.*

* Another reason is, that young trees taken from a nursery, have been somewhat exposed to the sun's direct light, and to the wind. Whereas, when taken from the forest, they are often transplanted from completely sheltered situations, where they have been protected from sun, wind and cold, and have, in consequence, a thin, delicate bark, inadequate to protect them in a new and more exposed situation. Young trees should be taken, for transplantation, from openings in the forest or from the edges, where they have been somewhat exposed, and thereby prepared to sustain the exposure to which they will be subjected. Otherwise they suffer, just as the young of any other living beings would, which, after having been nurtured delicately and in seclusion, should be suddenly exposed, unprotected, to the inclemencies of the elements.

When, therefore, a young tree is removed at once from the spot on which it grew, to that on which it is to stand, the end of the tap-root is almost necessarily broken off or much injured, always much retarding,—sometimes fatally,—the progress of the young tree. To obviate this evil, the French nurserymen make the acorn or other seed germinate in moist earth or saw-dust, and, before planting it, pinch off the end of the root. This causes the plant immediately to throw out side fibres. For the same purpose, it is the practice in England either to transplant the oak after one or two years' growth, removing at the time a part of the tap-root, or to cut it off without removing, by inserting a spade, obliquely, six or eight inches beneath the surface. In either case, the plant has several roots to depend upon, in place of its single original tap-root. In some cases, after it has grown in the place where it is to remain, for two or three years, it is cut down to the ground; it will then throw up vigorous shoots, and send down perpendicular roots. All but the most promising of the shoots may be carefully removed. This has been tried with marked success by Morrill Allen, of Pembroke, who has paid much attention to the cultivation of the oak.

The foreign oaks which seem most worthy of cultivation in this State, are the two native oaks of England. Both these have been introduced, and are growing in various situations in the neighborhood of Boston. They are perfectly adapted to our climate, and flourish as well and grow as rapidly, and mature their abundant acorns as surely, as any of our own oaks, except the red. When young, they are extremely beautiful and ornamental, and, when full grown, they are among the most magnificent trees known. The sessile-fruited oak, (*Quercus sessiliflora*,) is considered less valuable; the stalk-fruited (*Quercus pedunculata*,) being now almost universally preferred as a far superior tree. As objects of beauty, and for their value in the art of ornamental culture, as well as for use, no foreign trees present so strong claims to our attention.

The oaks are better fitted than almost any other trees, to stand along the borders of cultivated fields; as, where the soil is deep enough to allow it, they send their roots to a considerable depth, and thus disturb but slightly the growth of grass and other herbaceous plants and low shrubs.

II. 2. THE BEECH. *FAGUS*. Tournefort.

Lofty, spreading trees of the cool regions of Europe and America, distinguished for their smooth ashen or bluish grey bark, and three-cornered oily nuts, protected by a bristly or prickly, four-cleft bur. The leaves are annual, alternate and plaited while in the bud, which is sessile, and covered with imbricate scales. The male flowers are in roundish, tassel-like aments, dependent by a long, silken thread. The females, in roundish, sessile aments. Of this genus, there are only five or six species yet known; one is the common beech of Europe, and the western part of Asia, and of this, the American is supposed to be a variety; two are found in Chili; one or two, possibly three, are natives of Terra del Fuego.

THE AMERICAN BEECH. *F. Sylvatica*, L, var. *Americana*, Nuttall. *Sylvestris*, Michaux.

Figured in Michaux; Sylva, III, Plate 107; Abbott's Insects of Georgia, II, Plate 75.

For depth of shade, no tree is equal to the beech, and as it is singularly clean and neat, and the leaves are liable to the attack of few insects, and remain on the branches longer than those of any deciduous tree, giving a cheerful aspect to the wood in winter, it deserves cultivation near houses.

The roots do not penetrate deeply, but extend, just below the surface, to some distance on every side. The stem is remarkable for its smooth bark, of a whitish or bluish grey, or lead color, sprinkled with ash. When growing freely, it is an erect, often fluted column of eight or ten to twenty feet, at which height, it throws out, in every direction, many long, diverging or radiating arms, stretching upwards and outwards, at a large angle with the trunk. The lower branches of the lower of these, gradually become horizontal, while the upper ones ramify so as to form a broad, round, dense head. In the thick woods, it shoots up in a straight, erect trunk, to a height of sixty or seventy feet, clear, or with here and there a small, slender branch. The branches of the tree growing freely, or on the edge of a wood, are sometimes large, but more frequently small,

numerous, and irregular; the branchlets various, every second or third larger than the others; the spray short and distant, making sharp angles, slender and tapering to a point, with shining, deep purple bark, or of a beautiful chestnut red, indistinctly dotted with brown. The older branches become grayish, and gradually assume the blue gray of the trunk. On small trees, the bark is of a light, polished leaden gray. The tree has its finest shape when growing in an open forest, which has been made so by gradual clearing. It then unites magnificent height with great amplitude and length of head.

In an old tree the bark is rarely seen. But every part is usually covered with thin, membranaceous lichens, (*Lecanoras*, *Lecideus*, letter-like *Opegraphas*,) in clouds of every shade of white, gray, and brown, outside, which are often large patches of gray, yellow, and sulphur-colored foliaceous lichens, (*Parmelias*). Near the bottom, when growing in the forest, it is pencilled with delicate, threadlike, branching jungermannias, and about its base, has tufts of green and purple mosses.

In winter, it is distinguishable by its long, spindle-shaped, pointed buds.

From the density of the shade, from the slowness of the decay of the leaves, and from the fact that the roots run near the surface, few herbaceous plants are found beneath the beech. From these roots, however, young trees are often seen to spring, and this seems to be one of the ways in which the beech is propagated. When a tree is felled, the trunk throws out a profusion of shoots, which flourish for a year or two and then perish. The leaves, on these shoots, are usually of a rich crimson color.

The leaves, on old, fruit-bearing limbs, are in stars of four or five, at the ends of the branchlets. On the growing shoots, they are alternate, often inequilateral, on short, often hairy petioles, which grow from the under side of a branch and bend upwards. They are broad, lanceolate, narrowed below and somewhat heart-shaped, acuminate; the nerves parallel, never branched, ending in a single, large tooth. The surface is polished and shining, lighter beneath and hairy while young; texture thin and membranaceous. The leaves come out late, but often remain on the tree through the winter. The stipules are very long, slender, delicate and very transient.

The showy and beautiful flowers are in roundish tassels or heads, dependent by threadlike, silky stalks, of one or two inches in length, from the midst of the young leaves of a newly opened bud, whose long, delicate, ribbon-like scales are still adhering. Each flower is a hairy or silky, bell-shaped cup, with its border divided into six segments, and contains usually from six to twelve stamens. The fruit is on a hairy footstalk, from the axil of a leaf. The footstalk enlarges upwards into four fleshy, lanceolate scales, fringed, and set with stiff, sometimes double prickles. As it ripens, these open, disclosing two prismatic triangular nuts, whose edges thin out into a waved border.

The fruit, called beech mast, is a rich, oily nut. It is eagerly devoured by pigeons, partridges, squirrels, and other wild animals. Bears are said to have been very fond of it, and swine rapidly fatten upon it. Most varieties are so small as not very richly to repay the trouble of gathering, drying, and opening them. Fortunately, this is not the case with all, as the mast is a delicious nut. In France, the beech mast is much used for making oil, which is highly valued for burning in lamps, and for cooking. In parts of the same country, the nuts, roasted, serve as a substitute for coffee.*

The leaves were formerly used in Britain, and are, to this day, in some parts of Europe, for filling beds.† Evelyn says that, "its very leaves, which make a natural and most agreeable canopy all the summer, being gathered about the fall, and somewhat before they are much frost-bitten, afford the best and the easiest mattresses in the world, to lay under our quilts, instead of straw; because, besides their tenderness and loose lying together, they continue sweet for seven or eight years long; before which time, straw becomes musty and hard: they are thus used by divers persons of quality in Dauphiné; and, in Switzerland, I have sometimes lain on them to my very great refreshment. So as, of this tree it may properly be said,

'Silva domus, cubilia frondes.'—*Juv.*

'The wood's an house, the leaves a bed.'—*Sylva*, *Hunter's* ed., p. 141-2.

"We can," says Sir Thomas Dick Lauder, after quoting this passage, "from our own experience, bear testimony to the truth

* Loudon's *Arboretum*, p. 1963.

† *Ibid.*

of what Evelyn says here, as to the excellence of beech leaves for mattresses. We used always to think that the most luxurious and refreshing bed was that which prevails universally in Italy, and which consists of an absolute pile of mattresses filled with the elastic spathe of the Indian corn; which beds have the advantage of being soft, as well as elastic; and we have always found the sleep enjoyed on them to be peculiarly sound and restorative. But the beds made of beech leaves are really no whit behind them in these qualities, whilst the fragrant smell of green tea, which the leaves retain, is most gratifying. The objection to them is the slight crackling noise which the leaves occasion, as the individual turns in bed; but this is no inconvenience at all, or, if so in any degree, it is an inconvenience which is much overbalanced by the advantages of this most luxuriant couch."

The white beech grows in every part of Massachusetts, but it is only in the forests of the western part, that it attains its greatest height. It is there sometimes not less than one hundred feet high.

It flourishes best in a rocky, moist soil, and where this is rich, it grows with great rapidity, sometimes increasing two-thirds of an inch in diameter in a single year.

The wood is hard, of a fine, smooth, close grain, and very dense, having a specific gravity of .724. It is excellent for the turner's use, and fine large bowls, trenchers, and trays are made of it. In the northern part of the country, it is much used as fuel, and ranks next to rock maple.

It is preferred to all other woods for the making of plane stocks; and for this purpose, the wood which has grown most rapidly is found not only to have the smoothest and closest grain, but to be most durable, and least liable to warp. Plane stocks are, therefore, usually made of the outer, white, or sap wood, the heart, or red, being less tough.

It is also used for chair posts, of which great numbers are made of it, in Becket and the neighboring towns. It is used for saw handles, and for bodies of carts, it answers well for lasts, and is preferred for the cylinders used in polishing glass.

It is a valuable wood for fuel, comparing with hickory, accord-

ing to Bull, as 65 to 100, and its ashes furnish a great quantity of potash.

The beech is of very rapid growth. But it is seldom found over two and a half or three feet in diameter, and is universally considered a comparatively short-lived tree. Large trees are very often found decayed at heart; and it probably reaches maturity and begins to decay, in less than two centuries.

From its rapid growth and thick shade, it recommends itself as a screen against wind, to give shelter to a garden. But it has the disadvantage that nothing will grow under it, nor well, very near it. It is wanting in gracefulness, but there is an animating play of light from its polished leaves, and this, contrasting with its great depth of shade, makes it an agreeable object.

I have been unable to find more than one kind of beech in Massachusetts. The workers in the wood speak commonly of the white and the red; and I have often gone in pursuit of the varieties. But I have not succeeded in detecting any specific difference, and believe the appearance in the wood, which has given rise to these names, to be produced by the more or less rapid maturation of the wood. The heart wood is of a reddish hue. Where it predominates, the log is called red beech. Timber, in which the white sap wood is most conspicuous, is called white beech.

The beech is said never to be struck by lightning. In travelling through a forest country, many oaks may be found which have been so struck, but never a beech.

The beech of Europe differs so little from varieties of the American, that some botanists think them one species. There is doubtless a resemblance. But I am inclined to consider them distinct; much more distinct, certainly, than any varieties which I have been able to find in New England, are from each other. The leaves of the European beech are well characterized by Willdenow as "ovate, smooth, obsolete^y dentate, and ciliate on the margin." They are acute at each extremity. Those of our beech are narrow at base, and usually heart-shaped, decidedly serrate or sometimes dentate, acuminate, and ciliate only

while young; when they are not narrowed at base, they are strongly cordate. They are much larger than those of the European, and longer in proportion to their breadth; and the petiole, as well as the stalk of the fruit, is much less hairy. The aspect of the two trees is nearly the same. In the European, the difference between the sap and the mature wood is very slight; in the American it is striking. I have retained the specific name *Sylvatica*, as that by which our beech has been generally known.

There are several beautiful varieties of the European, propagated by budding, grafting, or in-arching, which deserve the attention of American arboriculturists. Among the most remarkable, are the purple, or copper beech, and the weeping. The original tree from which all the varieties of the former of these have been propagated, is said to have been discovered, by accident, in a wood in Germany, towards the end of the last century, and it is supposed to be still standing. "In early spring, when the leaves of the purple beech are agitated by the wind, during bright sunshine, their clear red gives the tree the appearance of being on fire; an effect, Bosc observes, so truly magical, that it is scarcely credible by those who have not seen it."—*Loudon*.

II. 3. THE CHESTNUT. *CASTANEA*, Tournefort.

A genus containing a single European species, which is also American, two dwarf species found in this country, an ever-green species on the hills of Oregon, and several species lately discovered in Nepal and Java, in Asia;—with deciduous, alternate, usually long, narrow and pointed leaves. The male flowers are in long, showy, rigid, axillary aments, which appear late, and soon fall; the female in a bristling involucre, which enlarges to a prickly bur, containing from one to three, smooth, roundish, thin-shelled, farinaceous nuts. It has a near alliance with the beech.

THE AMERICAN CHESTNUT. *Castanea vesca*, Gærtner, var.
Americana, Michaux.

Figured in Michaux ; Sylva, III, Plate 104.

This is one of the largest and tallest of our forest trees. It rises with a straight, erect stem, hardly diminishing in size, to the height of sixty or seventy, and, in the forests in the southwest part of the State, to ninety or one hundred feet. The bark on the old stocks is of a dark color, very hard and rugged, with long and deep clefts. In smaller trees, it is remarkably smooth, and so continues till they have attained a considerable size. When they are a foot or more in diameter, it begins to crack with long, superficial cracks, at the distance of two or three inches from each other. On each side of a branch, in the bark, is an oblique cleft ; the two meeting above the branch.

The recent shoots are large, of a deep green, or bronzed, or purplish brown color, channelled with two grooves running down from the base of each leaf, and closely set with prominent white or gray dots. The older shoots are of a darker color.

The leaves, which often come out in a diverging or radiant manner, are very long, from six to nine, and often ten or twelve inches, and one to two and a half or three inches wide, lance-shaped, tapering or rounded at base, ending in a very long point. The principal veins, which are regular, undivided and parallel, end in long, bent points, which are separated by large, curved indentations. They are green and polished above, and smooth and paler beneath, and are supported by stout footstalks, half an inch or an inch long. While quite young, they are covered with a glandular viscosity, but soon become smooth on both surfaces. On vigorous shoots from the stump, a pair of somewhat glutinous stipules, broad at base, and tapering to a point, defends the tender leaf, and continues, bristling at right angles, to protect it, until the footstalk is longer than they, when they fall off.

The male flowers, which come out later than those of any other forest tree, are in large, spreading bunches of stiff catkins, as long as the leaves, of a yellowish green color, and conspicuous

at a distance, like pale yellow rays, on the ends of the branches. They spring from the axil of the leaves, or are alternate, like the leaves, on the ends of the branches. The flowers are clustered in scattered groups, along the stalk of the catkin, and, when shedding their pollen, emit a strong and rather unpleasant odor. The fertile flowers are in burs, in the axil of the upper leaves, or, more frequently, near the base of the uppermost stalks of the sterile flowers; they are single, or two, three or more, near each other. The burs are, at the time of flowering, about half an inch long, on short, stout stalks, and are invested with crowded leaves and prickles, then very tender.

The fruit is covered with a bur, completely invested with crowded, sharp, and stiff bristles, which are not easily handled with impunity. It opens, when mature, by four valves, more than half way down, and contains the nuts, from one to three in number, in a downy cup. The nuts are roundish-ovate, tapering to a point, smooth below, and of a chestnut brown, and covered with a tawny down towards the tip. When more than one are in the bur, their contiguous sides are flattened.

In October, the fruit of the chestnut forms a tuft of lively, yellowish green, on the end of the branches, a striking object among the darker foliage.

The chestnut tree is found on the banks of the Mousum river, in the county of York, in Maine, a little beyond the 43d parallel of latitude, and thence southward, as far as Florida, and in the Western States. It is found in every part of Massachusetts, but does not readily and abundantly ripen its fruit in the immediate neighborhood of the sea. In all other parts, it yields an abundance of sweet and delicious nuts. Botanists consider it of the same species as the sweet, or Spanish chestnut of Europe. That tree was, originally, a native of Asia, and was introduced by the Greeks and Romans into the south of Europe, from which it has long since extended into the north and west. It was called *Castanea*, by the Greeks, from a town of that name in Pontus, whence they obtained it; and it gave its name to a town of Thessaly, to which it was early transplanted. It is probable that only the choicest varieties were propagated; and yet the fruit of most of the varieties

now growing in Europe, are not considered suitable food for man. Those which furnish so large a portion of the food of all classes, in the southern countries of Europe, and an important article of export, are cultivated varieties, with larger and sweeter nuts. This is an important fact. The nuts of the American tree are decidedly superior in flavor to most of those cultivated in Europe, but are much smaller, hardly a fourth part the size of the larger ones. Size and improved quality are the consequence of cultivation. By selecting the most valuable varieties of our native trees, and improving them by the arts of culture, we may hereafter obtain fruit superior to any now known. The extraordinarily rapid growth of the chestnut tree will give great facilities for the improvement of the species; and the abundance of the harvest from trees, affords another security against the failure incident to crops from bad seasons. The valuable varieties of the foreign tree may be introduced by grafting, or by planting. The grafts, or plants, of the most desirable kinds, may be readily imported from the nurseries of France and England; and they may be found already growing in Winship's and other nurseries in this State.

The wood of the chestnut is coarse-grained, the circles of growth being separated by numerous large pores or rather tubes; but it is strong and elastic, and very durable, even when exposed to alternations of dryness and moisture. It is, therefore, of great value for posts, which, when charred, will last more than twenty years, and for rails, in which form it will last half a century. It is also much used, as a substitute for oak and pine, in building; beams and joists, and other parts of the frame made of it, being almost imperishable. It is used for shingles, but is less valuable for this purpose, on account of its warping when exposed to heat. It is extensively employed in the manufacture of furniture. In the frame-work of articles to be covered with veneers of mahogany or other ornamental wood, it stands better than any other native wood. The frames of bureaus and sofas, and the bottom and sides of drawers are made of it. For these purposes much of it is brought into Boston from Worcester County. It has been sometimes used for hoops, but

is so far inferior to hickory and oak, that it is never used when they can be had. Its specific gravity is .522.

It is ill adapted to use as fuel, except for closed fires, the air in its numerous pores causing it to snap disagreeably; its value, according to Bull, being as 52 to 100, compared with hickory. But it forms an excellent charcoal; the younger trees furnishing the best and heaviest. For this purpose Michaux recommends its cultivation in copses. Its vigorous growth from the stump of a tree of any age, recommends it. Springing from the stump of a young tree, the shoots often make six or eight feet in a single year, and in the period of sixteen to twenty-five years they are fit to be cut.

"Chestnut copses," says Michaux, "are considered in France as the most valuable species of property; every seven years they are cut for hoops, and the largest branches serve for vine-props; at the end of fourteen years they furnish hoops for large tubs, and at the age of twenty-five years they are proper for posts and for light timber. Lands of a middling quality, which would not have produced a rent of more than four dollars an acre, in this way yield a mean annual revenue of from sixteen to twenty-four dollars."

The bark of the chestnut abounds in tannin and in coloring matter. It is therefore valuable to the tanner, and may be used by the dyer. With iron, the extract may form an exceedingly black ink. The wood seems to abound in tannin, and if reduced to chips, it would probably be found of value in tanning leather.

A large number of chestnut trees, which had grown in the forest, of from thirty-six to fifty-one years' growth, and varying from thirty-four to forty-one inches in circumference, gave, when carefully measured, very nearly three-tenths of an inch for the annual growth in diameter for the first forty or forty-two years. The circles, taken all together, were very nearly uniform. On the whole, they were decidedly broader near the circumference, showing that these trees were still growing, and more rapidly than ever before. The circles of one which had fifty-one circles in thirty-six inches, were very close near the centre,—twelve within one inch. It had probably been much

choked in its earliest growth by the surrounding trees. The two outer circles only were sap wood, and they were the broadest circles of all. In every instance save one, the inner circles were considerably the narrowest. The inference is, that, in the old forests, the chestnut grows less rapidly for the first ten or fifteen years, after which it continues to increase in rapidity of growth till it is upwards of forty-five or fifty years old. Growing from the stump, where the whole growth has been felled, it springs with excessive rapidity in the earlier years.

The chestnut tree is not only one of the most rapid growers, but it attains a great age. Some of the most remarkable trees of Europe are chestnut trees. On Mount *Ætna* is the famous *Castagno di cento cavalli*, so called from its having sheltered a hundred mounted cavaliers. Brydone found this, in 1770, two hundred and four feet in circumference, and it had the appearance of five distinct trees. A century before, when seen by Kircher, they were united, so that probably it had been one tree. The Tortworth chestnut, in England, was fifty-two feet in girth in 1820, when measured by Strutt. Near Sanserre, in France, is a tree of more than ten feet in diameter at six feet from the ground; it is supposed to be a thousand years old.

The circumstances of our country are not favorable to the existence of large trees. Few of them attain a great size in the forest, and in few places have the largest of the forest been left standing. An old tree is standing near Meeting-house Pond, in Westminster, which measured fifteen feet two inches in circumference at the ground, in 1839, but diminished rapidly, being but ten feet ten inches at four feet. An old, low tree, in the edge of Stow, between that town and Bolton, on the side of a hill, was fourteen feet two inches from two to five feet from the surface. Several remarkable trees were standing, in 1840, in the western part of Bolton. In July of that year, there was, on the land of Joseph Houghton, an old tree with an erect undivided trunk of forty or fifty feet and several large branches above, which measured twenty-one feet three inches at the surface, seventeen feet at three feet, and fifteen feet nine inches at six feet. Another measured twenty-two feet eight inches at the surface, seventeen feet six inches at three feet, fifteen feet six inches

at six feet. The trunk was undivided for twenty-four feet, where it put forth several large but short branches. A third was a perfectly vigorous tree, rising to eighty or ninety feet, with many large branches, at all heights above fifteen feet. It was eighteen feet nine inches at the surface, fifteen feet three inches at three feet, and thirteen feet two inches at six. A fourth, which measured nineteen feet eight inches at the surface, fifteen feet nine inches at three feet, and fourteen feet three inches at six, at nine or ten feet, threw out some large crooked branches, and then towered to eighty or ninety feet, with a magnificent, full, branchy head. In the near vicinity, on land of widow Rhoda Houghton, are many noble trees, three of which deserve to be recorded. One, a vigorous, well-branched tree, seventy or eighty feet high, measured, at the surface, at three and at six feet, twenty-two feet three inches, seventeen feet one inch, and fourteen feet ten and one-half inches. A second, beginning to decay, measured, at the same points, twenty feet five inches, sixteen feet two inches, and fourteen feet ten inches. A third, which at six feet divided into two main trunks, seventy or eighty feet high, measured, in like manner, twenty-two feet six inches, seventeen feet one inch, and sixteen feet seven inches in circumference.

In the stump of a tree recently growing on the same land, which measured four and one-half feet or fifty-four inches in diameter, one hundred and twenty circles were counted, indicating an annual growth of nine-twentieths of an inch. At the same rate, the largest of these trees may be a hundred and seventy or a hundred and eighty years old. Two trees in Hopkinton, on land of Mr. Valentine, measured, in 1826, one twenty-five and one-half feet, the other twenty-three feet at the ground.

South-east of Monument Mountain, near the road leading to Sheffield, in a pasture, an old chestnut measured, in September, 1844, at the ground, thirty feet two inches in circumference; at two feet, twenty-four feet seven inches, at four, twenty-one feet. At sixteen feet, it throws out several large branches, which form a top of sixty feet across. Some of the branches are decaying and ruinous.

Such fine old trees as these, wherever found, ought to be

spared. Nothing but the oak produces so superb an effect. An old chestnut throws out arms almost as strong as the oak, and its foliage forms as beautiful a mass and a thicker shade.

The chestnut flourishes on rocky hills, where there is no great depth of soil, on a surface difficult of tillage, and fit only for pasture or forest. Of the many acres of this description in various parts of the State, especially in the middle counties, it is to be hoped that a portion will be spared to this valuable and rapidly growing tree. A circumstance which gives additional value to this tree is, that the wood admits of a high polish, and beautiful furniture may be made of it.

The mode of cultivating the chestnut is similar to that for the oak. It is successfully raised from the nuts, which, whether they are to be sent to a distance, or to be reserved for eating, should be gathered in the sunshine and exposed several days to the direct rays of the sun. The chestnut may also be grafted in any of the modes in use for other trees.

The dwarf chestnut, a native of the Southern States, bears the rigor of our winters and forms a shrub six or eight feet high. It has a strong resemblance to the common chestnut, with leaves and fruit much smaller.

II. 4. THE HAZEL. *CORYLUS*. L.

The hazels are shrubs, or, in the single instance of the Constantinople hazel, *C. Colurna*, low trees, with alternate, entire leaves,—common in the cooler zones of both hemispheres. The male flowers, which come out very early, are in slender, cylindrical, pendulous aments; the female, in bud-like clusters, bristling with the long, thread-like, colored stigmas. There is one species, with many varieties, cultivated in Europe, one small tree, belonging to Turkey, and two species native to this country, the common, and the beaked hazel. The husk of the common hazel resembles a cap, whence its English name from the Saxon, *hæse*, a cap, and also its botanical, from the Greek, *corys*, a helmet.

The hazels are readily propagated by sowing the nuts, by suckers, and by layers.

THE AMERICAN HAZEL. *C. Americana.* Wangenheim.

The hazel is a small, branched shrub, from three to six feet high. The younger branches are gray and hairy, with green, or red, gland-bearing hairs, and afterwards become brown, lighter below, with orange, or green dots; the stem is dark colored. The leaves are broad ovate, or elliptic, heart-shaped at base, acuminate, coarsely and irregularly somewhat doubly serrate, hairy and rough, at last nearly smooth above, pale and hairy, with fine hairs, on the veins, veinlets, and axils beneath. The leaf-stalk is short, round, and covered with glandular hairs, which are scattered on the mid-rib, and sometimes on the larger veins beneath. Stipules broad at base, tapering to a point, sometimes toothed and cut, nearly as long as the footstalk.

The aments of the next year appear in the axils of the leaves in August. In March or April, those on which the sterile flowers are arranged, are found expanded into slender, cylindrical, tremulous catkins, two or three inches long, terminal, or dependent from lateral footstalks, single, or two to five together. They consist of deltoid, wedge-shaped, concave, pointed, hairy scales, pretty closely and imbricately arranged around a central thread, and each containing about eight anthers, attached by a short, minute thread, to a delicate, hairy membrane, with which it is lined, and which terminates in two scales, just below the edge of the outer one. These aments are of a grayish yellow, or fawn-color, and hang gracefully on their stalks, moving with every wind, and spreading in the air their yellow pollen.

The fertile flowers are little star-like tufts of crimson stigmas, projecting above a short, scaly bud of numerous scales; the outer scales are broader, and edged with hair, the inner ones hairy, lanceolate, and fleshy. In the axil of the central scales are the stigmas, which are long and thread-like, and divided to their base. The inner scales increase in size with the nut, and become the husk, two or three scales, very much enlarged, enclosing it entirely, and forming a cap.

The nut is about three-fourths of an inch in breadth, and somewhat less in length, roundish, slightly compressed, with a

bony shell of a light brown color, roughish at base, where it adheres, while immature, to its cap. This is an involucre of two broad leaves, much larger than the nut, green and fleshy when young, inflated at base, covered with coarse, glandular hair, deeply and irregularly cut, fringed on the compressed border, and turning grayish brown, when mature.

The hazel grows readily in dry, or moist, light soil, by the sides of woods or walls. The fruit varies much in quality in different places. In taste, it is fully equal to the filbert, and by many persons it is preferred. The finest specimens of it are equal to the filbert in size; if these were selected, and carefully cultivated, they would, as all other fruits have been found to do, with similar treatment, improve in quality. In England, the filbert is much cultivated, and is sometimes a very productive crop. Miller says that its qualities can only be preserved by propagating by suckers, or layers. The same methods might be used for our hazel. By selecting the largest, finest, and earliest nuts, sowing them in the most propitious soil, and selecting from those plants which soonest come to bearing, the most promising nuts, for seed, and thus constantly repeating the operation, the size, productiveness, and flavor of the fruit would, doubtless, be greatly improved. The improved varieties might be easily propagated by suckers, of which it is the nature of the hazel to throw out great numbers.

There are many road sides and borders of fields which might be planted with the hazel, from whence, with little expense, a desirable addition to the table might be raised, which children could be employed to gather. Hazel-gathering is, even now, in some parts of New England, a pleasant little festival for children; and the remembrances of the nooks among the woods, and the thickets along the river banks, to which the search for nuts leads, are not unwelcome, in graver and busier years.

The common hazel is found from Canada to Florida, and through the Western States.

The plant is too small to be of much service, though it may possibly have as much virtue as the European species of which Evelyn writes: "The coals are used by painters to draw with, like those of sallow: lastly, for riding switches, and divinatory

rods for the detecting and finding out of minerals; at least, *if that tradition be no imposture.*"

THE BEAKED HAZEL. *C. Rostrata.* Aiton.

This is a somewhat smaller shrub than the common hazel, being from two to six feet in height, and it is of much less frequent occurrence. Yet there are few country towns in which the boys are not acquainted with the taste of its nuts. The recent shoots are brown and smooth, sprinkled with a few gray dots. The older branches are rough and darker, and the stem a grayish brown. The leaves are on very short, nearly smooth footstalks, pear-shaped, narrowed towards the base, and heart-shaped, ending in a point, doubly and irregularly serrate, smooth above, somewhat downy or hairy beneath. The nut is small and roundish, enclosed in a bristly husk which fits its shape at the base, but is lengthened into a jagged beak at the extremity, like a narrow, long-necked bottle. By this it is easily distinguished from the common hazel, as well as by the inferiority in the size and quality of the nuts. These grow on the ends of the branches, in bunches of two to eight or nine; most of which never come to perfection.

This is a northern species. Dr. Richardson found it in Canada, as far north as the Saskatchewan. On the highest mountains of the Alleghany range, it occurs in the southwestern part of the country.

Messrs. Prince, of Long Island, found that the European hazel grows perfectly well in our climate; a single bush annually producing half a bushel of filberts.

The Constantinople hazel is a tree of sometimes fifty or sixty feet in height.

FAMILY III. THE HORNBEAM FAMILY. *CARPINACEÆ*.

This family is nearly allied to the oak family, from which it is distinguished by having its female flowers arranged in a loose terminal ament, which becomes an open, pendulous, compound fruit resembling a hop. The male flowers are on long, cylindrical, tassel-like aments, formed of simple, imbricate scales, with twelve or more stamens attached to the base of the scales.

It contains small trees, found in the temperate zone of both hemispheres, remarkable for the solidity, strength and toughness of their wood; with annual, alternate, simple, entire leaves. The buds are covered with imbricate scales, investing and separating the plaited leaves.

It comprehends two genera of trees found here: The Hornbeam, with its naked nut concealed in the axil of a leaf-like bract; and

The Hop-Hornbeam, whose nut is covered by a hairy, inflated, membranous sack.

III. 1. THE HORNBEAM. *CARPINUS*. L.

Small trees, with a smooth, fluted or irregular trunk, and alternate, entire leaves. The female flowers are in loose aments, made of small, scale-like, changed leaves, in pairs. These, enlarged, contain the fruit, which is a small, ribbed, bony nut in the angle of a changed, halbert-shaped, or three-lobed leaf. There are about six species, one of which only is found in New England.

THE AMERICAN HORNBEAM. *C. Americana*. Michaux.

Figured in Michaux; Sylva, Plate 108.

The hornbeam is a small tree, easily distinguished by its trunk, which is marked with longitudinal, irregular ridges, resembling those on the horns of animals of the deer kind. From its great resemblance to the European species, it received at once from the earliest settlers this good old English descrip-

tive name.* The bark is smooth, like that of a beech, and of a dark bluish gray or slate color, whence it is sometimes called the blue beech.

The trunk is a short irregular pillar, not unlike the massive, reeded columns of Egyptian architecture, with projecting ridges which run down from each side of the lower branches. The branches are irregular, waving or crooked, going out at various but large angles, and usually from a low point on the trunk. The recent shoots are very slender and tapering, somewhat hairy, and brownish or purple. The older branchlets are of a dark ashen gray with a pearly lustre.

The leaves are very much like those of the black birch. They are on short footstalks, elliptical or oblong, two to three inches long and one to one and one-half broad, rounded at the base, sharply and unequally serrate, smooth and slightly impressed at the veins above, paler and softly hairy along the veins and with a prominent tuft of hair at the axil of the veins beneath. The footstalk is a little hairy; the buds oval. The autumn colors of the leaves are different shades of scarlet and crimson.

The male catkins come out before the leaves, on the sides of the branches. They are an inch or usually less than an inch long, and look as if they had been stunted in their growth. They are set with broad-ovate, pointed scales, within which are twelve or more anthers resting by their base on short filaments. The female catkins come out of the same bud with the leaves, at the ends of the smaller branches, so that the fruit is in clusters terminating a short, leafy branchlet. When mature, the compound fruit-heads are on very slender footstalks of from one to two-thirds their length, and consist of a series of alternate pairs of transformed, sagittate leaves, growing together at base, and forming each a cup enclosing an egg-shaped, eight-sided nut, in a thin, dark brown, ribbed husk, crowned with the stigma. The

* Gerard thought otherwise in regard to the derivation of this name. He says, of the corresponding English species, "The wood or timber is better for arrowes and shafts, pulleyes for mils, and such like devices, than elme or wich-hazell; for, in time, it waxeth so hard, that the toughness and hardness of it may be rather compared to horn than unto wood; and therefore it was called hornebeam or hard-beam.—*Herball*, p. 1479.

nut is flattened on one side, of a woody texture, and contains a small kernel which tastes somewhat like a chestnut.

When growing by itself, in open ground, the hornbeam is a low tree, with a broad, round, crowded, leafy head, the lower branches bending nearly to the ground on every side. Its general aspect and figure are like those of the beech, and it is more uniform in its appearance than any other tree.

It is found in every part of the State and in almost every variety of soil except the most barren; but flourishes only in rich moist land. It is never a large tree. I measured one by the side of the Agawam River, near Chester Village, which was three feet nine inches in circumference above the bulging of the roots, and about thirty feet high; one in Brookline measured two feet six inches at two feet from the ground; and I have often seen it of similar dimensions. It is usually five or six inches in diameter and about twenty feet high. From the situations in which it is commonly found growing, on the steep sides of river banks, and cold, clayey hills, it is rarely erect, but generally inclined obliquely upwards, with very large, spreading branches.

It is of slow growth, and is supposed to live to a great age. The wood is white, close-grained and compact, and has great strength. It is used for beetles, levers, and for other purposes, where strength and solidity are required; and it is well fitted for the use of the turner. The corresponding species in Europe is much esteemed as fuel, and in France its charcoal is preferred to most others. The hornbeam is a tree of considerable beauty. Its smooth, fluted trunk is an interesting object to one curious in forest history; its foliage is remarkable for its softness, and the fruit is unlike that of every other tree. The crimson, scarlet and orange of its autumnal colors, mingling into a rich purplish red as seen at a distance, make it rank in splendor almost with the tupelo and the scarlet oak. It is easily cultivated and should have a corner in every collection of trees.

According to Michaux, this tree is found in Nova Scotia, and Pursh found it in Florida. It is common in all the New England States, in New York and Pennsylvania, and in Carolina and Georgia.

III. 2. THE HOP HORNBEAM. *OSTRYA*. 1.

To this genus belong low trees or shrubs of the temperate zones in both hemispheres. The sterile flowers are in cylindrical, pendent aments; the fertile, in short, slender aments, which, when mature, have a striking resemblance to a hop, and are made up of inflated sacks containing a brown nut. There are few species, of which one is a native of the south of Europe, and one only, of this country.

THE AMERICAN HOP HORNBEAM. *O. Virginica*. Willdenow.

Figured in Michaux; Sylva, Plate 109; in Abbott's Insects, II, Plate 76; and poorly in Audubon's Birds, Plate 40.

The hop hornbeam is a handsome, small, slender tree, easily distinguished when in fruit by the resemblance of its spike of seed-vessels to a hop. The leaves are similar to those of the black birch and of the hornbeam, from the former of which they may be distinguished by the absence of the chequer-berry taste, and from the latter, by being more elliptical. The twigs are distinguished from both by their extreme toughness. The bark on the trunk is dark grayish, and is remarkable for being divided into very fine portions, three or four inches long, easily scaling off, narrower than the divisions on any other rough-barked tree, and continuing to become finer and narrower as the tree grows older.

The branches are rather small, long and slender, and make a large angle with the stem, forming an open head. The bark on the younger ones is smooth, and of a reddish copper or bronze or dark purplish brown color, like the cherry tree, dotted with white or gray. These dots lengthen horizontally, as on the bark of the birch, and the smoothness and deep color continue till the branch or stem is two or three inches thick, when the bark begins to crack and become grayish.

The recent shoots are very slender, of a reddish green dotted with brown; the older shoots are small and tapering, giving, with the leaves expanding in the same plane, great softness of appearance to one of the toughest trunks of the woods.

The leaves are three or four inches long, and two wide, oblong ovate or elliptical, heart-shaped at base, beautifully tapering to a long point, unequally and sharply serrate, smooth above, paler and somewhat hairy, particularly at the axils and along the veins, beneath, thin, of a delicate texture, and sitting on very short, often hairy footstalks. In autumn, the leaves assume various shades of orange brown, or yellowish brown, and russet.

The barren flowers, which expand in May, at the same time with the leaves, or just before, are in cylindrical, pendulous catkins, one or two inches long, of a tawny, brown, or purple color, at the ends of the twigs of the last year. The scales of which they are formed are very short, broad ovate, acuminate, thickly ciliate, and hairy at the base within. The stamens are twelve or more, one-celled, bearded at tip, resting, near their base, on short, irregularly branched, hair-like filaments.

The fertile flowers come from the same bud with the leaves, so that they are at last at the end of a leafy branch. This bud is enclosed by several scales, and each leaf, plaited and folded together within, has at its base a pair of thin, pointed, striate, stipular scales, which soon fall. The leaves and the minute branches are invested with bristle-like hairs. Above the leaves are the slender catkins, half an inch long, made up of very hairy, long, pointed scales, which soon fall off. Within them are the smaller but more permanent scales which protect the future fruit. Several of the lower ones contain nothing. The upper ones protect each two saeks, conical at base, and ending in cylindrical, hairy tubes, from which project the two hair-like, purple or red stigmas, surmounting the enclosed ovary. At the period of the bursting of the anthers, the female catkin is three or four tenths of an inch in length. This rapidly enlarges, and, at maturity, is an inch, or sometimes two or three inches long, and of half that width. This compound fruit is a collection of follicles, resembling a hop, erect, finally pendulous, on a club-shaped, hairy stalk of the same length, terminating the branchlets, and a conspicuous ornament in July and after. The seed-vessels, to the number of twelve to twenty, are aggregated in pairs. Each is an ovate, flattened, membranaceous, veined,

inflated, sessile sack, half an inch long, terminating in a point, and set at base with numerous, needle-like, stinging hairs, and containing at the base a dark brown nut of nearly the same shape, three or four lines long, free, except at base, where it adheres to the sack.

The wood of the hop hornbeam is close-grained and compact, and remarkably tough and stiff; on account of which properties, it is often used to make levers and is called *lever-wood*. It is also called *iron-wood*, from its extreme hardness, and is well adapted to make cogs in mill-wheels. It is suitable for stakes of carts, for binding-poles and for all similar uses.

This tree seldom grows to a large size. I measured one in Roxbury, near the rail-road, where it occurs abundantly, which was three feet two inches in girth at the ground, two feet six inches at four feet, two feet eight inches at five and one-half feet. On the road leading from Pittsfield to Williamstown, in Lanesborough or beyond, in a field on the right, I measured, in September, 1838, one which had a circumference of five feet and eleven inches at the ground, and another of four feet nine inches.

In Bristol County, this tree is sometimes called black hazel, and Indian cedar.

Dr. Richardson found the hop hornbeam in Canada, as far north as Lake Winipeg. Michaux found it in New Brunswick and Nova Scotia. It occurs in all the New England States; in New York; in Pennsylvania; and in Carolina and Georgia.

FAMILY IV. THE WALNUT FAMILY. *JUGLANDACEÆ*.

DE CANDOLLE.

The plants belonging to this family are lofty timber trees, found native in the northern temperate regions of both continents. They are distinguished for their compound, pinnate leaves, exhaling an aromatic odor when crushed; the barren flowers borne on simple or compound pendulous catkins; the fertile, in a small terminal group, or solitary. There are few genera;—one common to Europe and this country, one peculiar to this country, and a few others more recently and less perfectly known.

The kernels of several of the species are sweet and wholesome, abounding in oil. The rind of the English walnut is extremely astringent, the rind and the bark of the butternut possess cathartic properties, and the husk and bark of both species of American walnut and of several of the hickories, may be used in dyeing. The wood of all is highly valuable as timber.

Insects on the Walnuts and Hickories.—The caterpillar of the beautiful *Luna* moth, (*Attacus Luna*; Harris's Report, p. 277), feeds on the leaves of the hickories and walnuts. So does a species of the *Limacodes* or slug-caterpillars, (ib. p. 303). Swarms of caterpillars of one or perhaps several species of *Pygæra* are found on the same trees, (ib. p. 313). The smaller limbs of the pignut hickory are found, during July, covered on their lower surface by clusters of the *Aphis caryæ*, (ib. p. 190), which suck their sap; and the bark and wood of this tree are bored, sometimes very extensively, by the larvæ of a Buprestian beetle, (ib. p. 40). Grubs of the *Apate basillaris* sometimes destroy the shellbark by boring to its heart, where they undergo their transformation, (ib. p. 76). The caterpillar of the walnut sphinx, (*Smerinthus juglandis*), feeds on the leaves of the black walnut and the butternut, (ib. p. 230), and the most magnificent of the American moths, called by Dr. Harris the regal walnut

moth, *Ceratocampa regalis*, feeds on the leaves of the black walnut, (Report, p. 287).

The two American genera of the Walnut Family, are the Walnut and the Hickory.

1. The Walnut has its flowers in simple, undivided aments, its fruit covered by an undivided husk, and its leaves made up of very many leaflets,—from eleven to twenty-three.

2. The Hickory has its sterile flowers in compound aments, the husk of its fruit opening naturally by four seams, and its leaves of fewer leaflets,—from five to nine.

I. THE WALNUT. *JUGLANS*. L.

Spreading, round-headed timber trees, natives of North America and Persia, with rough bark, and deciduous, aromatic, compound leaves, made up of many leaflets, as many, usually, as from five to eleven pairs with an odd one. The sterile flowers are in large, undivided catkins, from buds distinct from the leaf buds, each flower containing from eight to thirty-six stamens; the fertile are solitary or in small groups at the end of the branches. The fruit is large, and covered with a spongy, odorous, undivided husk.

Before the introduction of the mahogany into Europe, the wood of the European walnut was much employed in the construction of furniture. Its chief use now is for gun-stocks. The kernels of the walnuts abound in oil, which is prone to become rancid, either in the kernel or when expressed, and is then unwholesome. Properly dried, the nuts are sweet, wholesome and nutritious. The expressed oil is not congealed by cold, and, drying on exposure to air, it is useful in painting. It is also used in cookery, as a substitute for the olive and almond oils. The nut-bread, left after the expressure of the oil, is nutritious, and is used to fatten poultry and other domestic animals. The bark of the several species is bitter and astringent, and has been recommended in fevers, and to give tone and strength to the stomach. The sap abounds in sugar, which crystalizes on evaporation, like that of the sugar-cane. Fer-

mented, the sap affords an intoxicating liquor called walnut wine.*

There are two species found native in New England :

1. The Butternut, known by its long, ovate fruit, covered with clammy hairs, and
2. The Black Walnut, whose fruit is nearly round, not hairy, but slightly rough with granular points.

Sp. 1. THE BUTTERNUT OR OIL NUT TREE. *Juglans cinerea*. L.

Figured in Bigelow's Medical Botany, Plate 32 ; in Michaux ; Sylva, Plate 31 ; and in Audubon's Birds of America, Plate 142.

A low, broad-headed tree rising to the height of thirty or forty feet, and spreading to a considerable distance on every side. Even in the forest it shows little disposition to soar to a great height. The recent shoots are of a light greenish gray, downy, soon becoming of a clear light gray, obscurely dotted. The branchlets of last year are stout, smooth, of an ashen brown, with gray dots, the scar of the leaf conspicuous and large. The branches are horizontal or slightly inclining upwards, very long, irregular, with a gray bark, soon cracking and growing rough with grayish superficial rifts, the lenticular dots long and lighter-colored ; on the very large branches the prominent rugosities often cross each other diagonally, cutting the surface into lozenges, or the clefts separate, widening into diamonds ; while the trunk, covered with a dark granite gray bark, is rough, with clefts not running into each other. The leaves are compound, twelve to eighteen inches long, with from three to seven, rarely eight, pairs of sessile leaflets, and an odd one which is supported on a prolonged footstalk. The common footstalk is stout at base, tapering, rounded or angular, or often flattened horizontally below the leaves and vertically between them, very downy, as is the lower surface of the leaves. The leaflets are from two to four inches long, and somewhat less than half as wide, lance-ovate, rounded at base, gradually tapering to

* Burnett's Outlines ; II, p. 528.

a prolonged point, serrate, rather thick and rough, and lighter colored beneath. The buds are destitute of external scales.

The sterile flowers issue from the sides of last year's shoots, in large green catkins four to seven inches long, and four or five eighths of an inch or more in diameter. They are on oblong, shield-like, green scales, disposed pretty closely on all sides of the catkins. Each scale terminates in a brown, hairy tuft, above which are three lanceolate, pointed lobes, with two lateral lobes midway of the scale. The stamens are about eight to twelve, sessile, brown on the upper surface, which, by the pendency of the catkins, becomes the lower.

Fertile flowers, two, six or seven on a terminal downy stalk. Each is surrounded by an involucre of several broad scales, forming at base the oblong cup, and within them are five or six narrow, pointed sepals, immediately investing the long style, which terminates in a large purple or rose-red stigma, deeply cleft, two to three eighths of an inch long. The cup, which enlarges to become the fruit, is invested with numerous reddish or white glands, which exude a penetrating, viscid substance.

The leaf-stalks and recent shoots are set with similar glands in less number.

The flowers appear in May, and the fruit ripens in October.

The fruit grows single or two to five together on the sides and end of a stout, pliable footstalk, which is one to three inches long. They are green, turning to brown, oblong-ovoid, or inversely pear-shaped, invested with glandular hairs, which secrete a clammy, resinous and penetrating odorous substance, and crowned by the stigma and ends of the calyx scales. Within a thin, leathery husk, they contain a nut about two inches long, and of half that thickness, covered with stony, opposite, keel-like projections, and sculptured with deep furrows and sharp irregular ridges. It is rounded at base, and acute at the end, and about an inch in diameter. The kernel of this nut is of one piece, but can with difficulty be extracted whole. It is of an oily nature, and soon becomes rancid; but when carefully dried is sweet and very pleasant.

The butternut tree abounds on the Hoosic Mountains, among the Green Mountains, on the sides of the Wachusett, and par-

ticularly in the Connecticut valley, where it attains a very large size. It is of very rapid growth when young.

From the bark of this tree an extract is made, which is sometimes employed as a medicine, and is valued as a safe purgative, peculiarly mild in its operation. The bark and the nut-shells are also used to give a brown color to wool. The Shakers at Lebanon dye a rich purple with it. Bancroft says that the husks of the shells of the butternut and black walnut, may be employed in dyeing a fawn color, even without mordants. By means of them, however, greater brightness and durability are given to the color. The bark of the trunk gives a black, that of the root a fawn color, but less powerfully. From the sap an inferior sugar has been obtained. The leaves, which abound in acrid matter, have been used, in the form of powder, as a substitute for Spanish flies.

The young, half-grown nuts, gathered early in June, make excellent pickles, and are much used for that purpose, the clammy down being removed, before pickling, by plunging them in boiling water and rubbing with a coarse cloth.

The wood is light, of a pale reddish color, of little strength, but durable when exposed to heat and moisture, rather tough, and not liable to the attacks of worms. For gun-stocks, it is equally stiff, elastic, and tough with black walnut, but less hard.

It makes beautiful fronts of drawers, as used by the Shakers at Lebanon, and excellent light, tough, and durable wooden bowls. In the western part of the State, coffins are often made of it. Where abundant, it is used for posts and rails, and for the smaller timbers in house frames. It is sometimes used for the panels of coaches and other carriages, being pliable, not splitting when nails are driven into it, and, from its porosity, receiving paint extremely well.

Michaux says that the butternut is found in Upper and Lower Canada, on the shores of Lake Erie, in the States of Kentucky and Tennessee, and on the banks of the Missouri. It occurs in all the New England States, and in New York and Pennsylvania.

In Richmond, I measured a butternut tree which was thirteen feet and three inches in circumference in the smallest place below

the branches. I have found trees of nearly similar dimensions in many parts of the State, and much larger ones on the Connecticut River.

Sp. 2. THE BLACK WALNUT. *J. nigra*. L.

Figured in Catesby, Plate 67; in Michaux, Sylva, I, Plate 30; and in Audubon's Birds of America, II, Plate 156.

A fine tree with spreading branches and a broad round head. The bark is rough and furrowed, and darker than that of the butternut tree.

The leaves have from six to ten pairs of leaflets and an odd one. They differ from those of the butternut by being smooth above, while those of the butternut are rough; in having the leaf-stalk smooth, the leaves more smooth on both surfaces, more strongly serrated, less sessile, and a little more pointed, with the leaf-stalk less swollen, and the buds smaller. The fruit is round, and on a short footstalk; that of the butternut, long, ovate, and on a long footstalk.

It is found in Massachusetts, but comes to its greatest perfection, and displays its fullest proportions in the States on the Ohio. On the banks and islands of that river, Michaux says he has often seen trees three or four feet in diameter, and sixty or seventy feet in height, and that it is not rare to find them of the thickness of six or seven feet. "When it stands insulated, its branches, extending themselves horizontally to a great distance, spread into a spacious head, which gives it a very majestic appearance." As it is found growing with us, it is remarkable rather for beauty than for majesty; yet if the flourishing young trees which are now to be seen are allowed to increase for a century, they will probably merit the encomium bestowed by Michaux.

The sterile flowers are loosely set on green, simple catkins, from four to seven inches long, dependent from the axil of the last year's leaves. Stamens very numerous, twenty to thirty or more, green, short, sessile, close set within a nearly circular perianth of six rounded lobes. The fertile flowers are sessile on a terminal common footstalk, an inch or more long. Each cup

is surmounted by a many-toothed circle or involucre, within which are four slender, lanceolate lobes, encircling the style with its long, deeply bifid, purple or red stigma. Recent shoots slightly downy or powdery, as are the leaf-stalks.

The leaves are very long, with from fifteen to twenty-one leaflets; the leaf-stalk downy; leaflets on a short petiole, nearly smooth, downy on the mid-rib above and beneath, ovate-lanceolate, with a long acumination, inequilateral at base, lower ones cordate, middle ones rounded, upper ones acute below and serrate.

Recent branchlets very downy; fruit-stalk somewhat downy. Fruit globose, nearly smooth, or somewhat granulate, and of a greenish yellow when mature, but soon turning to a dark brown. Within the spongy husk is a rough, deeply furrowed nut, round, but slightly flattened, with a woody or bony covering. The kernel, which nearly resembles that of an English walnut in shape, is more oily, but, when carefully dried, of a rich and very agreeable taste.

The wood of the black walnut is of a dark violet or purple color, becoming deeper and almost black with age. It is valuable for its fineness of grain, tenacity, hardness, strength and durability. These qualities, together with its beauty and toughness, render it preferable to any other material for the stocks of muskets. The wood is beautifully shaded, and admits of a fine polish, and it is now very extensively used in the manufacture of tables, chairs, bureaus, bedsteads, and other cabinet work, and sometimes for book-shelves and the cornices and panels of rooms. Where abundant, it serves the same useful ends that hickory does with us. Posts made of it last for more than a quarter of a century. It is brought into the State in considerable quantities for the purposes above mentioned. More nearly than any other American tree, it resembles the European walnut, which, before the introduction of mahogany, was considered the most beautiful material known for the best kinds of furniture.

Its erect stem and the breadth of shade from its abundant, soft and luxurious foliage, recommend it as an ornamental shade tree. It is perfectly adapted to our climate. It is found growing naturally in small numbers, or solitary, in several

parts of this State, and it has been successfully cultivated in many others. Its growth from the seed is certain and rapid. Its rich, oily fruit, when carefully dried, is nearly equal to that of the shagbark hickory. From the kernel a valuable and abundant oil may be expressed, superior to most others for use in cookery and for lamps. Bread has also been made from the kernels. The spongy husk of the nuts is used as a dye-stuff. It thus unites almost all the qualities desirable in a tree;—beauty, gracefulness, and richness of foliage, in every period of its growth; bark and husks which may be employed in an important art; fruit valuable as food; wood unsurpassed in durability for use, or in elegance for ornament.

IV. 2. THE HICKORY. *CARYA*. Nuttall.

The hickories are valuable timber trees, with large compound leaves, having from five to fifteen, but usually not more than eleven leaflets. The sterile flowers are in compound catkins, each principal catkin having two opposite branches; the stamens from four to eight in each flower. The fertile flowers are solitary, or in small groups, at the end of the branches. The fruit is a large roundish nut, the husk of which opens partially or wholly, of itself, by four seams.

The hickory is peculiar to America. The nearest approach to it on the Eastern Continent, is in the European walnut. In many respects, it is amongst the most valuable of our trees. It is always a stately and elegant tree; and the several species, and individuals in the same species, exhibit so great a variety of appearance and foliage, that they have almost the interest of a forest. Few trees contribute so much to the beauty of the woods in autumn. The colors of all at that season are rich, and each species has its own. The smoothness, closeness, and hardness of the grain of the wood, give it great value in the arts, and for fuel it holds unquestionably the first place. The fruit of some of the species, even in the unimproved condition of its forest state, vies with the best of foreign nuts, and is destined, doubtless, to be greatly improved by the resources of cultivation.

With such claims, it has a right to demand more attention than it has yet received.

From the great resemblance which several of the species have to each other, in shape, and in the size, form, and number of the leaflets, they are liable to be confounded, and distinct species are confounded almost universally. Except when in fruit, it is very difficult to distinguish them, and even then it is necessary for the inexperienced observer to have recourse to the taste, so great and numerous are the diversities in their size, shape, and external appearance. The hickories are stately trees. All of them have, more than any other native deciduous tree, a tendency, even when growing by themselves, on the open plain, to rise to a great height, and form a tall cylindrical head, not wide, but holding a breadth of twenty or thirty feet, with only such breaks and irregularities as preserve it from sameness, to the very top. This is a great beauty, and serves to give a marked character to the tree when seen at a distance, left, as it often is by our farmers, an ornament and shade to the pasture, or standing by itself on the edge of a wood, or along enclosures. This great beauty of the tree would recommend it for transplantation to the sides of commons and public roads, if it were not for the great difficulty with which it is removed, after it has attained any considerable height. The principal root, except, perhaps, in the case of the bitternut hickory, is a very long and perpendicular taproot, with few fibres or side roots. It is therefore liable to be so much injured in transplanting, from the loss of the extremity, that few trees survive the operation. To be successfully propagated, it must therefore be raised from the seed, sown where the tree is finally to remain. In our bleak and windy climate, few trees will grow without shelter in their earlier years. The hickories should be raised in large masses, of several acres at least. And the nuts, previously made to germinate in boxes, filled with earth, and kept moist in the cellar,* should be sown so plentifully, as to allow for casualties, such as the depredations of squirrels and other small animals,

* Michaux, *N. A. Sylva*, I, p. 205. He adds, "The success of this simple method is certain."

and still remain growing pretty thickly. Their growth at first is slow, but it is more rapid in proportion to the completeness of their protection on every side. When the young plants have attained the height of from five to eight feet, they may be thinned out for the purpose of making walking-sticks, for which the consumption is very considerable, and the demand constantly increasing. When at the height of fifteen or twenty feet, and from two to four inches in diameter, they may be still further thinned for hoops. The value of the young and growing trees for fuel, will be a sufficient inducement to continue the operation of thinning to as great a degree as is necessary for the best growth of the larger trees, which may be left standing for timber, for ornament, or for the fruit. Hickories managed in this way, drawn up at first by being surrounded by other trees, and afterwards gradually exposed to the action of the sun and air, will have their peculiar beauties developed in the fullest manner. It is merely an imitation, by art, of the mode by which some of the best trees of this kind now standing, have been formed.

The uses to which hickory wood is put, are very numerous. Great numbers of walking-sticks are made of it, as for this purpose no other native wood equals it in beauty and strength. It is next in value to white oak, for making hoops, of which great quantities are made in the State, and many more imported. The price these bring is such, that it is doubtful whether land of a suitable quality can in any other way be made so productive, as in raising them. Hickory makes the best screws, the smoothest and most durable handles for chisels, augers, gimlets, axes, and many other common tools. Seasoned wood of some varieties of the pignut and mockernut trees, is equal in durability to iron wood or *lignumvitæ*, for mallets and heads of beetles, being tougher and more durable than white oak. The sailor prefers a hickory handspike. Its smoothness and tenacity recommend it for the screws of presses, the rings which confine the sails of small vessels to the mast, and for the cogs of grist-mills. The carriage maker employs it for the springs of gigs, the whiffle-trees of stage coaches, and the shafts of light wagons. The farmer makes of it the teeth of his rakes, bows for his yokes, and handles for his axes; uses it, when white or yellow

oak cannot be readily found, for axle-trees, saws it into planks for barn-floors, and applies it to many other purposes. For tide mills, it is preferable to oak timber, as it is not attacked by worms when in salt water.

Its defects are that it shrinks much and irregularly, and therefore warps, that it is liable to the attacks of worms, and decays rapidly when exposed to moisture. As is the case with most other woods, that is most valuable which has grown most rapidly, and which, in consequence, has least of the red heart-wood. That of the pignut is heaviest, next in succession the shellbark and mockernut, in the proportion, when green, of 31, 29, and 25.

As fuel, hickory is preferred to every other wood, burning freely, even when green, making a pleasant, brilliant fire, and throwing out great heat. Charcoal made from it is heavier than that from any other wood, but it is not considered more valuable than that of birch or alder. The ashes of the hickories abound in alkali, and are considered better for the purpose of making soap than any other of the native woods, being next to those of the apple tree.

The shellbark hickory ought to be cultivated for its nuts. These differ exceedingly in different soils and situations, and often on individual trees growing in immediate proximity. There is a common idea, which seems to be well founded, that the excellence of the nut is proportioned to the roughness of the bark. An observation of the elder Michaux encourages us to hope that the fruit may be greatly improved by cultivation. He says that the fruit of the common European walnut, in its natural state, is harder than that of the pacanenut, and inferior to it in size and quality.*

The species of hickory common in Massachusetts, are four :

1. The Shellbark, with five large leaflets, a large nut, of which the husk is deeply grooved at the seams, and with a rough, scaly trunk ;
2. The Mockernut, with seven or nine leaflets, a hard, thick-shelled nut, and leaflets and twigs very downy when young, and strongly odorous ;

* N. A. Sylva, I, p. 137.

3. The Pignut, with three, five, or seven narrow leaflets, small, thin-shelled fruit, and a pretty hard nut; and

4. The Bitternut, with seven, nine, or eleven small, narrow, serrated leaves, small fruit, with long prominent seams, bitter and thin-shelled nut, and very yellow buds.

Sp. 1. SHELLBARK HICKORY. *Carya alba*. A. Michaux.

Leaf, fruit, and female ament figured in Michaux, Sylva, I, Plate 36, and in Plate 12 of this volume.

This tree is almost every where in Massachusetts known by the descriptive name of the shagbark, or shellbark, a name likely to be retained. It is the only one of the hickories which is not constantly confounded with some other. It may be readily distinguished by the shaggy bark of its trunk, the excellence of its globular fruit, its leaves, which are large and have five leaflets, and by its ovate, half-covered buds.

The shellbark hickory is found in the county of York, in Maine, twenty-five miles east of Portsmouth, N. H. This is the most northerly point at which I have observed it, and there it is rare, and a small tree, but matures fruit of a fine quality. It occurs thence southward through the Middle and Southern States, as far as Carolina, and is found in the Western States.

It flourishes in nearly every part of Massachusetts, except the southeastern counties. In the maritime districts, and in sandy soils, it is rarely found. It is most abundant in the neighborhood of Boston, and in Middlesex, Essex, and Worcester counties.

It grows best in a rich, moist soil, and produces its fruit most abundantly when growing by itself on the border of cultivated land, or on the edge of a forest. In such situations, a single tree sometimes bears several bushels of nuts.

The shellbark is a tall and stately tree, rising sometimes to the height of seventy or eighty feet, with a diameter seldom exceeding two feet. The branches are irregular and scattered, often numerous, but not large, and where the tree is left standing, after the other trees of the forest in which it had attained its height, have been felled, it has a long and shapely, cylindri-

cal head, of great beauty. Where it has grown almost by itself, from an early age, it often becomes a spreading tree, with a fine broad, but somewhat open head. In the forest, its rugged trunk may be seen stretching up, with scarcely perceptible diminution, and without a limb, to a height of fifty or sixty feet. It is covered with a bark of remarkable and characteristic appearance. It is of a dark granite or ashen gray, and by a few distant, deep furrows, the external portion is separated into long plates, which cleave nearly off in large loose flakes, attached only by the centre, or one end. This singular exfoliation of the bark does not occur in very young trees, and we sometimes find them bearing fruit with a bark almost as smooth as the mockernut or the pignut hickory.

The branches, if compared with those of most other trees, are small, but are larger than those of the other hickories. The recent shoots are stout, at first grayish or greenish brown, afterwards purple, smooth, and dotted with numerous long, light-brown dots, obliterated in the older shoots, which become of a very dark gray. The leaves are large, and of five leaflets, of which the side ones are inequilateral, and nearly sessile, while the terminal leaflet is on a short footstalk. The lower pair are small, narrow, ovate lance-shaped; the upper pair and the terminal one very large and broad, and inversely egg-shaped. All end in a long point, and are coarsely serrate, smooth and dark green above, of a yellowish green and downy beneath, on a round, yellowish green footstalk. In October, they become of an orange brown or orange russet, and finally a deep russet. The buds are middle sized, ovate, yellowish brown, half covered by the two external scales. Early in the spring, these scales fall off, and the buds enlarge to a very considerable size. In May or June, they open by the folding back of the large, conspicuous scales, which are numerous, from two to five inches long, and often one or two broad, widening towards the end, and of a rich purple color, invested externally with yellowish silken down. They are tough, of a soft leathery texture, and beautifully fringed.

From the midst of these gorgeous, flower-like scales, appear the leaves, expanding late, but hastening to atone for the delay

by luxuriant and rapid growth, and reaching, before the end of June, on the vigorous shoots of young trees, their full length of eighteen or twenty inches.

The male flowers are in slender, pendulous, green tassels or catkins, three on each common stalk, which comes out at or near the base of the new shoots, the middle one from three to five inches long, the opposite lateral ones half as long, or more, with a small, slender scale at the base of each. The shining, imbricate scales of the catkins contain each three or four stamens. The inconspicuous fertile flowers are in groups of from two to four together, on the ends of the shoots, containing each two stigmas, surrounded by the four parts of the calyx, which, by their surprising development, form the husk of the future nut.

The fruit of the shellbark is nearly globular, varying much in size, but usually from five to seven inches in circumference. The husk is, in its immature state, green and nearly smooth, but afterwards turns brown, and sometimes almost black. It is of a spongy substance, very thick, and marked with four depressed furrows, by which it separates into as many distinct pieces, one of which is larger than the rest. The nuts, which differ in size and shape, still more than the unhusked fruit, are about an inch long, and from two to two and a half in circumference, white or yellowish white, oblong, and compressed, marked with four distinct angles, corresponding to the seams in the husk, prolonged at the extremity, and crowned with the hardened remains of the stigma. They vary very much in hardness and thickness; the best varieties being thinner and softer, and having commonly a rounder and fuller shape than the poorer sorts. The kernel is very sweet, much superior in quality to that of any other native nut, and, in the best varieties, it is equal to any imported nut. It ripens in October. Every fruit, which is much used for food, except this, has been improved by the careful cultivation of many centuries. The shellbark hickory is a proper subject for experiments, to be made with special reference to the improvement of the nut. Those varieties should be selected, which unite, in the greatest degree, thinness of shell, with fullness and richness of kernel. If as great a change can be wrought as has been effected in the

common European walnut, which, in its wild state, is small and thick-shelled, the fruit of the shagbark will be far superior to any nut now known.

The market of Boston and the other towns of this State, are supplied with these nuts from the vicinity, or the interior of the State, not abundantly enough, however, to prevent a considerable importation from New York and other southern ports.

The wood of the shellbark hickory splits more easily than that of the other species, and has more elasticity. It is therefore preferred for whip-stalks, goads, and ox-bows; and sometimes it is used for making baskets. It has less strength and tenacity than the wood of the pignut hickory, though it possesses in a high degree these characteristic properties.

As fuel, it stands at the head of the list of trees belonging to our climate, or probably to any other. Foreigners who have settled among us, regard it as clearly superior to any wood known in Europe. It is the heaviest of our native woods, and yields, pound for pound, or cord for cord, more heat than any other, in any shape in which it may be consumed.

This tree does not often grow to large dimensions. One between the branches of the Nashua river, in Lancaster, and near their confluence, measured eleven feet five inches at the ground, eight feet six inches at three feet, and seven feet six inches at six feet.

Sp. 2. THE MOCKERNUT HICKORY. THE WALNUT. *Carya tomentosa*. A. Michaux.

Figured in Michaux, Sylva, I, Plate 35; and in Plate 13 of this volume.

This species is often called the walnut, and is also known by the name of the square-nut hickory. It is also called white heart, though, in old trees, the heart is of the same dark red as in the other hickories. It is liable to be confounded on one side with the shellbark, and on the other with the pignut hickories. The name mockernut is sometimes heard in this State, and is given to it exclusively in New York. This, like the preceding, is a stately, tall, and finely shaped tree, with an erect trunk, throwing out a few moderately large branches, at a sharp angle,

and forming a lofty and graceful pyramidal head. It may be distinguished from the other hickories by the number of its leaflets, which are seven or nine, by the down on its leaves and recent shoots, by the hardness of the husk and the thickness of the nut, by the roundness of its large covered buds, and by a strong resinous odor in the leaves, buds and husks. In its general aspect, it resembles the shellbark, as well as in the fullness of its foliage and the size of its leaves. Its branches are more spreading, and its trunk is more like that of the pignut hickory, but less smooth. The color of the bark is dark ashen gray, and on old trees it is rough with numerous close, narrow furrows, rendering it more rugged than that of any hickory, except the shellbark. A remarkable peculiarity often shows itself in the young trees. While the inner bark is cracked, the cuticle seems to yield and to cover the whole surface with a smooth, waved covering; the external furrows not beginning to show themselves until the tree has a diameter of six or eight inches.

The recent shoots are of a brown color, very stout, and, early in the season, covered with down. Later, they turn purple, with a dusty appearance. On the older branches, which are larger than in the other species, the color changes to gray which gradually becomes lighter.

The leaves are very large, often eighteen or twenty inches long, on very large downy footstalks. The leaflets are seven or nine, nearly sessile, except the terminal one, which has a short stem; they are rather large, egg-shaped, elliptical, or pear-shaped, smooth above and downy beneath, with large, sharp serratures, and terminating in a short point. They are remarkable, particularly in the early part of the season, for a strong resinous odor. They have more substance than those of the other species, and shrivel less under the touch of the frost. In autumn, they assume a full deep orange brown, gradually fading to russet.

The buds are large, round, short, and covered with downy, yellowish brown scales.

The male flowers are on triple catkins from three to six inches long, the middle one longest. They consist of three-lobed,

pointed scales, imbricately arranged, and differ from those of the other species in being somewhat more hairy. The fertile flowers are very small, and consist of a calyx with four segments, from which issue two hairy, irregular, ragged stigmas.

The fruit of the mockernut varies remarkably in size, shape and appearance, but is commonly from four to six inches in circumference. It is sometimes nearly orbicular and smooth, with slightly depressed furrows, but more frequently pear-shaped, with prominent seams and a granulated surface. The husk separates nearly to the base into four unequal lobes, sometimes as thick as those of the shellbark, and sometimes quite thin, but always becoming very hard. It has, in a remarkable degree, the strong resinous scent characteristic of the species. The nuts are whitish, commonly somewhat pear-shaped, and less compressed and with less prominent angles than those of the shellbark. But a variety is found with prominent angles, and is distinguished by the name of the *square nut*. The shell is very thick and hard, and difficult to crack. The kernel is sweet, and, in some varieties, as large as in the shellbark, but the difficulty of extracting it, makes it far less valuable. The fruit ripens in October.

The wood is characterized by the hardness, tenacity and weight which belong to all the trees of this genus. It is less easily cleft than that of the shellbark, but next to it in value as fuel, and less tenacious than that of the pignut, and therefore less valued for its uses in the arts. But the differences in these respects are so slight, that only the most careful observers have noticed them. When young, it is supposed to be whiter than that of the other hickories, and thence the tree receives the common name of white heart hickory. The Indians made of the bark of one of the hickories, probably this, with the assistance of a vegetable acid, the only kind of acid they had, a black dye, said to have been deep and permanent.

Michaux, who had made experiments upon the several species, pronounces the mockernut to be the slowest in its growth of all; and he thinks it is the most liable to the attacks of worms, and therefore one of the least valuable for cultivation. He says it grows on poorer soils than the other species, but

attains a considerable size only when growing on a rich soil. In this State, it flourishes in company with the shellbark, and prevails in the eastern parts, particularly in the vicinity of Boston, and more on the southern side than on the northern or eastern.

Sp. 3. THE PIGNUT HICKORY. *Carya porcina*. F. A. Michaux.

Figured in Michaux, Sylva, Plate 38 ; and on Plate 14 of this volume.

Although the pignut hickory occurs more frequently than any other species, yet the name is often made to include the mockernut and the bitternut.

The bark of the pignut hickory is broken into finer and more numerous rugosities than either of the preceding species, and begins to assume its roughness at an earlier age, and on smaller trunks and branches. Its color is a rather light bluish, ashen gray, and it is often clouded with large patches of gray and sulphur-colored, or bluish lichens. On old trunks, the bark is comparatively smooth, but sometimes broken into larger and less regular plates than the mockernut, and the plates are rough and often projecting, somewhat as on the shellbark.

The recent shoots are smaller than those of the two preceding species, tapering, smooth, often polished, purple, with numerous long dots, and gradually turning brownish gray ; the larger branches are of a uniform bluish gray. The leaves are long, with three, five, or seven leaflets, on a long, smooth footstalk. The leaflets are nearly sessile, narrower than in the former species, smooth on both surfaces, tapering gradually at both extremities, and ending in a long point. The terminal leaflet is inversely egg-shaped, on a short stalk. When crushed, the leaves, as well as the husk of the nuts, give a not unpleasant odor, entirely different from the characteristic odor of the mockernut hickory. In autumn, as early as October, the leaves change their color, becoming of a russet orange, or often a rich orange with a brown tint overspread.

The buds are egg-shaped and pointed, or rounded, smaller than in the last species, the outer scales of a polished brown.

The fruit of the pignut hickory varies still more in shape

than that of the other hickories, and hardly less in size. It is sessile on a short terminal stalk, and most commonly pear-shaped; at least, that is the shape which I have found most common in Massachusetts, and that almost universally connected with a leaf of five leaflets. This has been called the *fig-shaped*, (*ficiformis*), from its resemblance to a fresh fig. Another variety, also common, has the fruit nearly round, but often irregularly shaped; and a third, less common, has a large broad fruit. These differences in the shape of the fruit are connected with corresponding differences in the leaves, bark and appearance of the tree, inducing several botanists to consider them as distinct species. Michaux is probably right in making them only varieties. The husk has a smooth or granular surface, with seams depressed above and often prominent below, and sometimes so from top to bottom, extending nearly to the base, and dividing it into four unequal lobes. It is very thin, though not equally so in all the varieties, and crustaceous, but not hard. The nut has a hard and tough shell, sometimes thin but oftener pretty thick, of a bluish gray color and smooth surface. The kernel has at first a hazel-nut taste, which turns presently to a disagreeable bitter. Some varieties have a nut almost equal to an inferior shellbark. The nuts grow single, or two, three, or four together. They are often very abundant, several bushels being produced on a single tree, and they are then usually found growing in pairs.

The wood of the pignut hickory, varying greatly in the different varieties, has, in some, the excellent properties of this class of trees in greater perfection than either of the other species. It is therefore preferred for the axle-trees of carts, the heads of mallets and beetles, and the handles of axes. A beetle made of it, and used to drive stakes and iron wedges, outlasts, I am told, any that can be made of any other wood, foreign or native. As fuel, it is next to the species already described, and superior to all other woods.

This hickory grows to a great size, being sometimes three or four feet in diameter, and rises to the height of seventy or eighty feet, with a trunk very gradually tapering, and pretty large limbs.

Sp. 4. THE BITTERNUT HICKORY. *Carya amara*. F. A. Michaux.

Figured in Michaux, Sylva, I, Plate 33 ; and on Plate 15 of this volume.

This species, though perfectly distinct and well defined, is very generally confounded with the last described, or, if at all distinguished, is called the bitter pignut.

It may be easily recognized by the smallness and slenderness of its leaves, which give it much the aspect of an ash, by its small, pointed, yellow buds, by the winged projections at the upper part of the fruit-seams of the husk, and by the bitterness of the kernel of the thin-shelled nut.

The bitternut hickory is found abundantly in the vicinity of Boston, particularly in Chelsea and Brookline. In Cambridge, and the towns beyond, it less rarely occurs, its place being taken by the pignut, as it is in Dorchester and towards Milton hills. On the hills in Brighton, the four species are more equally mingled than I have found them elsewhere. It also occurs in Worcester County, and in the counties along the Connecticut.

The bitternut hickory is the most graceful of these beautiful trees, and remarkable for its finely cut foliage.. It raises a noble columnar top, to the height of sixty or seventy feet, enlarging upwards, and broadest at forty or fifty. The trunk gradually tapers from the ground; less rough than most large trees, with a few loose portions of its light granite gray bark here and there projecting, and differing from the color of the other hickories by a faint yellow tinge. The recent shoots are of an orange-green, smooth, and dotted with orange dots. As they grow older, they change to a brownish gray. The buds are small and very characteristic; they are of an orange-yellow color, the terminal ones long, curved, flattened and pointed, the axillary ones shorter and rounded. By observing these, the tree may be easily distinguished at any season of the year.

The leaves are on small stalks, which are somewhat downy, and often flattened and winged. The leaflets are from seven to eleven, small, narrow, lanceolate, sessile, inequilateral, smooth on both surfaces, or with a slight scattered down beneath.

They are of a lively green, and, in autumn, assume often a rich orange color, a faint tinge of which they retain when the other species have grown russet and brown. Such is the prevailing character of the leaves in this vicinity. Elsewhere they are sometimes very large.

The male flowers are in ternate, pendulous catkins, from three to six inches in length, very slender, and somewhat downy, and bristling less with the prolonged points of the scales than in the other hickories. The inconspicuous fertile flowers are on the ends of the branchlets, single, or two or more together, remarkable, when closely examined, for the very broad stigmas which overlie the segments of the scaly and resinous calyx, the future envelope of the fruit.

The fruit of the bitternut hickory is nearly round, or slightly compressed on one side, and is distinguished by the prominent winged edges of the seams, only two of which extend more than half way down. The husk is smoothish, or slightly granulated, thin and fleshy, and never becomes very hard. The nut is white and smooth, broader than it is long, and somewhat heart-shaped at the top. The shell is so thin, that it may be broken by the fingers, and contains a kernel remarkably corrugated, and so bitter, that squirrels refuse to feed on it while any other nut can be found, and even boys will not eat it. From the bark or husks of some one of the hickories, probably this, the Indians are said to have procured materials for coloring a permanent yellow.

These are all the hickories of whose occurrence in Massachusetts I am confident. The varieties of the pignut may hereafter be elevated into species; and the species called by Michaux the nutmeg hickory, will probably be found here. I have seen nuts and leaves, which reminded me of the description and figure of this species, but, forgetting their locality, I have been unable to verify my conjectures by observation.

FAMILY V. THE BIRCH FAMILY. *BETULACEÆ*. RICHARD.

The birch family consists of graceful trees and shrubs, natives of the colder regions of each hemisphere, with alternate, entire, dentate or serrate, deciduous leaves. The sterile and the fertile flowers are arranged in distinct aments on the same plant. The male flowers are in cylindrical, pendent tassels or aments, made up of three-flowered scales, on the sides or ends of the branchlets, the female in shorter, thicker aments, usually erect, of two- or three-flowered scales, with long, diverging, colored stigmas. Both are made up of imbricate scales. The fruit, called a strobile, is the enlarged female ament, usually more or less egg-shaped, sometimes cylindrical. The aments are formed in the summer, or early autumn, and remain unprotected through the winter.

The bark is thin, and generally arranged in thin flakes, and has astringent properties. The root is rather large, with long, tapering branches, and numerous radicles. The wood is soft, close, and fine-grained, rather light, and not durable when exposed to alternations of dryness and moisture. Several of the birches are valuable as timber trees, most of them as fuel, and all as ornaments in the landscape. They abound in the northern parts of America, and are sometimes found in the mountains of Mexico and countries farther south.

The great defect of birch timber is its proneness to decay. This may be in a degree prevented by felling the tree in summer, or in early autumn, and immediately stripping off the bark. So long as the bark remains, the sap and other moisture favorable to decay, is kept in, and the seasoning prevented.

The birches have a great abundance of sap, which is sometimes obtained in large quantities by tapping the vigorous trees. It is sweetish, with an agreeable acid taste, and forms a pleasant drink. It is said to be sometimes used, with perry, in the manufacture of what seems to be, while new, tolerably good Champagne wine. It is also used to make vinegar. The inner bark of some species is used to give a bright orange dye.

Trees of the birch family are nowhere of more importance, variety and beauty, than in this country. There are but two genera :* 1. The Birch, known by its thin and delicate leaves, and bark made up of strong, horizontal fibres; and, 2. The Alder, known by its thick leaves, polished, dark-colored bark, and woody, cone-like, persistent strobiles.

V. 1. THE BIRCH. *BETULA*. Tournefort.

This genus has its sterile aments, made up of imbricate scales, arranged in threes, with twelve stamens placed beneath the middle scale, and its fertile aments of three-lobed scales. The ovary is much compressed, crowned with two styles, and divided into two cells, the ovule in only one of which comes to maturity. The seed-vessel is a samara with thin, winged, membranous borders, like that of the elm. The buds are sessile, covered with imbricate scales, and contain the leaves folded together, and overlying each other. The leaves are alternate on the growing branches, and in pairs elsewhere; on the canoe, the gray, and some other birches, they are sprinkled with glutinous dots when young. The sterile aments make their appearance in July, remain unprotected on the branches through the autumn and winter, and expand, before the leaves, with the earliest warmth of spring. The scales of the fertile aments detach themselves easily, and fall from their stems, which are always undivided. This genus contains not far from twenty species, of which nine or ten are found within the limits of the United States or its territories. The rest belong to the north of Europe, except one found in Japan, one in Terra del Fuego, and some which grow among the mountains of Central Asia.

No trees are more distinguished for their light and feathery

* The *Clethropsis*, a plant of the interior of Asia, discovered by V. Jacquemont, and described from his specimens, by Cambessedes, must take its place, apparently, between the birch and the alder, and nearer to the latter. See *Voyage dans l'Inde, par Victor Jacquemont*, Tome IV, p. 158, Plate 159.

Whilst this sheet is passing through the press, I learn, from the eleventh volume of Spach, *Histoire des Végétaux*, which I had not before seen, that he has placed *Clethropsis* in this family. He has also made two other genera, from species of *Betula* and *Alnus*.

foliage, and the graceful sweep of their limbs, than the birches. From the delicate and slender gray birch, throwing its thin leaves and often pensile spray lightly on the air, to the broad-headed black birch, with its rich, glossy and abundant foliage, weighing its pendulous branches almost to the ground,—no family affords such a variety of aspect. There are five birches in Massachusetts which are trees, besides one which is a shrub. They are thus distinguished :—

1. The Black Birch, by having its bark dark colored ;
2. The Yellow Birch,—bark yellowish, with a silvery lustre ;
3. The Red Birch,—bark reddish or chocolate-colored, very much broken and ragged ;
4. The Canoe Birch,—bark white, with a pearly lustre ;
5. The Gray or White Birch,—bark white, chalky, dotted with black ;
6. The Dwarf or Shrub Birch,—bark covered with glandular points, a shrub.

Michaux arranged the birches in two sections : one comprehending trees whose fertile aments are sessile and erect ; the Black, the Yellow, the Red, and the Glandular, birches ; the other, those whose fertile aments are stalked and pendulous, the Canoe, the White, and the common European. The division seems a very natural one, bringing together those which are most nearly allied in habit, and in the qualities of their wood.

Sp. 1. THE BLACK BIRCH. SWEET BIRCH. *B. lenta.* Linn.

Figured in Michaux, Sylva, II, Plate 74.

The black birch is easily distinguished by the dark color of its bark ; and from this obtains the name by which it is almost universally known. From its resemblance, in bark and leaves, to a cherry tree, it is also sometimes called the cherry birch ; and from the agreeable spicy odor and taste of the leaves and inner bark, it often has the name of the sweet birch, or fragrant birch, as in Bryant's lines on the murdered Traveller,—

“The fragrant birch above him hung her tassels in the sky,
And many a vernal blossom sprung and nodded careless by.”

The black birch is the most beautiful, and, for the useful properties of its wood, the most valuable of its family.

Early in spring it expands its long aments, which hang like tassels of purple and gold, and continue for many days shedding beauty and fragrance, at a time when few other objects feel the kindly influences of the season; and it is amongst the first trees to put forth its leaves. In the forest, in the rich, cool, moist soils which it prefers, on mountain sides, or the banks of streams, it often attains the height of sixty or seventy feet. On an open plain, growing by itself, it is a round-headed tree, and from the length and slenderness of its somewhat tortuous branches, they become pendulous, forming the most graceful of the weeping trees. It is found in every county, but flourishes most in the mountainous districts. The light, winged seed often lodges and vegetates in crannies of almost inaccessible rocks, and thence pushes down its roots, over the bare rock, to a considerable distance, in search of a foothold in the soil. It is often, too, seen growing from the top of the mass of soil and stones adhering to the roots of an old, overturned tree.

The trunk in small trees is covered with a smooth, dark purple bark, entire, or, in larger trees, with distant chinks. On very old trunks, it is broken into horizontal, straight-edged plates, which become loose at the end, and scale off in broad sheets. The spray is very slender, of a reddish bronze color, gradually deepening to a very dark polished bronze, almost black, dotted with conspicuous gray dots. The buds are conical and pointed. The leaves are two or three inches long, and one, or one and a half wide, oblong-ovate, heart-shaped at base, tapering to a point, finely and sharply but irregularly serrate, smooth and somewhat impressed on the veins above, paler, and with the veins straight and prominent, and hairy beneath, the under surface dotted with numerous resinous, but not viscid dots. They are on short curved footstalks sometimes a little hairy. On the lower parts of the branches, they are in twos, towards the ends, alternate. In autumn, they assume various shades of ochreous yellow, or pale orange, or an extremely delicate yellow, lighter than orange, nearly a lemon color.

The male flowers are on cylindrical, pendulous catkins, from

two to four inches long, and one quarter of an inch wide, set with loosely arranged scales. Each flower is within a broad-ovate, shield-like, pointed, brown scale, to which are attached two smaller ones below, and within, three thinner, bearded scales, supporting twelve stamens with single-lobed anthers, growing by twos on pedicels, with often a slender scale at the base of each. These catkins are towards the end of the branches, occupying each the place of a pair of leaves.

The female flowers are on smaller catkins, about half an inch long and one eighth in diameter, lower on the branches, with two leaves at the base of each. The scales are close set, imbricate, small, green, rounded or pointed at the end, with an ear-like lobe on each side at the base. Within each are three pairs of ovaries with awl-shaped stigmas.

The fruit is erect, nearly sessile, elliptical, or cylindrical with rounded ends, an inch or somewhat less long, and half an inch thick, made up of shining, resinous scales of three equal lobes, closely imbricated, and having three seeds, ovate and with broad wings, within each.

Michaux found this tree in Nova Scotia, in Maine, and "on the estate of Vermont," as Loudon has translated him; also in the Middle States and on the Alleghanies, throughout their whole extent, till they terminate in Georgia.

The wood is easily wrought, and, as it has strength, firmness and durability, it is much used in the arts. It has a delicate rose color, which deepens from exposure, but never becomes dark, and the difference between the annual circles of different degrees of maturity, giving a rich, clouded, or, as it is technically called, landscape appearance, it is in request for the panels in the foot and head-boards of bedsteads, and in other cabinet furniture. It is sometimes used to make yokes, which proves its strength to be considerable. It is also used for joists, for bedsteads and for chairs, for which it is a beautiful material, though it does not bend so well as yellow birch. Small tubs are made of it, and it is sometimes used for back-boards in carriages.

The black birch is excellent for fuel, next, indeed, to the rock maple, in the Green Mountains, and in the northern part of New England, where it comes to the greatest perfection. A

decoction of the bark, with copperas, is used for coloring woollen a beautiful and permanent drab, bordering on wine color.

In a pasture south of Meeting-house Pond, in Westminster, among the broad clumps or islands of broad-leaved laurel, I found a black birch in July, 1839, which, at three feet from the ground, measured nine feet and five inches in girth. This tree was remarkable for the projection of the roots just above the surface, for the deep rifts in the old bark, which peeled off in broad plates, and for an enormous fungus which had attached itself to the bottom of one of the cracks. This measured eighteen inches across, eleven in height, and projected eleven inches horizontally from the trunk.

Sp. 2. THE YELLOW BIRCH. *B. excelsa*. Aiton.

Figured in Michaux, Sylva, II, Plate 73.

In its native forests, the yellow birch is a lofty tree, lifting its head into the sunshine among the tall hemlocks, rock maples and ashes, with which it grows. It is distinguished by its yellowish bark of a soft silken texture, and silvery or pearly lustre. The recent and still growing shoots are slender, of a reddish, purplish, or deep bottle green, somewhat hairy, and dotted with gray. The older branchlets are of a polished copper or golden bronze, or of a dark alder green, with often a thin, grayish, transparent film scaling off horizontally in rolls. On the larger branches in young trunks, the bark begins to assume a metallic lustre, with the horizontal dots long and conspicuous, and the epidermis loose in narrow strips, hanging out like the frayed ends of narrow ribbons. The trunk then begins to take a yellowish color, and thin lichens intersperse their black-dotted, white clouds. On vigorous trunks of a foot in diameter, are seen long rolls of loose bark adhering by the middle or by one end; while, in very old trees, the trunk becomes rough, with large, broad, gray scales, separated by furrows, and giving lodgment for the mosses, and liverworts, and larger lichens, which abound in the deep shades of the primeval woods. The yellow birch is often found seven or eight feet in circumference, measured above the bulging of the roots, and with only two or

three large branches, near the top, at sixty or seventy feet from the ground. The roots often swell out above the surface in a picturesque or sometimes fantastic manner.

The leaves, except on the growing shoots, are in twos, on short, curved, hairy footstalks. When they first come out, they are covered with hair. They are oval or elliptic, or more or less egg-shaped, contracted towards the base and heart-shaped, tapering to a rather long point, more coarsely serrate than those of the black birch, the serratures prolonged, smooth or a little hairy above when mature, pale and hairy along the mid-rib beneath. On the green, hairy, growing shoots, the leaves are alternate, with short, taper, lance-shaped stipules, which soon fall off. In autumn, the leaves become of a soft, pale yellow.

The catkins of the male flowers are two or three inches long, at the ends of the branches, somewhat larger and shorter than on the black birch, but, like them, hanging like golden and purple tassels on the branches, just as the leaves are beginning to unfold. The scales are slightly fringed. The aments of the fertile flowers are short and nearly erect, in the common axil of two leaves, on the sides or ends of the branchlets. When fully grown and mature, they form an egg-shaped cone, about an inch or an inch and a quarter long, and four or five eighths of an inch thick, nearly sessile, erect, and formed of stiff, tough, three-lobed scales, hairy without, and containing, within, three inversely kidney-shaped winged seeds, with the two brown styles in a notch at the top.

The yellow birch has not often been cultivated for ornament, but it has great beauty. In travelling, we sometimes see it on the edge of a wood, with its abundant soft, green, often drooping foliage, between masses of which is seen the gleam of the light bronze trunk with its silver and pearly lustre,—showing what might be its effect introduced in ornamental woods.

The wood of this tree is applied to numerous uses. Bending readily, it is particularly adapted to the making of the posts and bars of chairs. It is used for the staves of small and inferior casks, for boot-trees, and for joists and bedsteads. In Richmond, among the Shakers, floors are made of it, as also of the black birch. It is valuable as fuel.

At Lanesboro', I measured, in 1838, a yellow birch, of ten feet seven inches girth at the ground.

Sp. 3. THE RED BIRCH. *B. nigra*. Aiton.

Figured in Michaux, Sylva, II, Plate 72.

This tree is somewhat different in aspect and character from the other birches. It is usually found bending over a stream with its roots always in the water, or growing, in company with the swamp white oak and red maple, in places which, during one half the year, are inundated. In such situations, it is rarely erect, but commonly bends towards the water. When erect and standing alone, it is a singularly graceful tree, with its upper limbs long and sweeping out like those of an elm, and its trunk almost clothed with small, leafy, pendulous branches. Usually, it is remarkable for throwing out many small branches near the ground, and for the denseness and multitude of its branches above. The stem, in trees thirty feet high, is covered with a reddish-white bark more loose and torn than that of any other tree. The external bark, wanting the great tenacity of the white and canoe birches, separates, in flakes an inch or two broad, adhering by one end, while the other projects like an ample fringe. The color of this loose bark, when seen by transmitted light, as we see it from the ground, is a light red; when seen by reflected light it is a reddish brown or chocolate color. The trunk on old trees is dark gray, very rough, with little resemblance to that of any other birch except the black, and very much like the black cherry, but not so dark.

The recent shoots are brown and downy; those of a year or more are black, dotted with light gray. The branches are very numerous, small, dependent, with bark on the larger ones brownish or whitish red, and excessively ragged. Leaves heater-shaped, or rhombic, the larger ones three or three and a half inches long, and two or two and a half wide, uniformly acute at the base and at the extremity, conspicuously doubly serrate, bright green above, glaucous beneath. The leaf-stalks are short, and, with the leaf, downy when recently expanded. The bark within is of an ochrey orange red; the wood, white and hard.

This tree is found growing abundantly on Spicket River and in neighboring swamps in Methuen. It is there called the river birch. As fuel, it is said to be nearly equal to hickory, and the tree is of very rapid growth. The wood is close-grained and very hard, and, when kept dry, very durable. It has not been much used in the arts. Yokes have been made of it, which are excellent, except that they are apt to crack from exposure to the sun; which defect may be obviated by water-seasoning.

The trees are usually about a foot in diameter and fifty feet high. One measured five feet two inches in circumference, and appeared to be sixty feet high.

The younger Michaux assumes the banks of a small river in New Jersey, ten miles from New York, as the northern limit of this birch. He found it abundant in Virginia and North Carolina, but rarely more than two or three feet in diameter and seventy feet high. It would probably flourish as well in Massachusetts as in either of those States, as its growth is very luxuriant in the limited region to which it seems to be here confined. The seed-bearing cones are said to be ripe in June.

Michaux says that the wood is pretty compact and nearly white, and presents the peculiarity, like that of the June berry, of being longitudinally marked with red vessels, intersecting each other in different directions. The negroes make bowls and trays of the wood, and, of the young stocks and of branches not exceeding an inch in diameter, hoops, particularly for rice casks. In Philadelphia, its twigs are made into brooms for streets and court-yards. A similar use is made of the twigs of the gray birch in some parts of New England.

The red birch might be easily propagated along the streams of every part of New England, and would serve the same purpose as the alders, in preventing the washing away of the banks, while it would form a still more beautiful fringe, and furnish a useful growth for fuel, and for the arts.

Sp. 4. THE CANOE BIRCH. *B. papyracea*. Aiton.

The leaves and strobile are figured in Michaux, Sylva, II, pl. 69; the tree, leaves and aments in Loudon, Arboretum, VII, Plate 236.

The paper birch is a northern tree, being found as far north as latitude 65°. It grows naturally on river banks and in moist, deep soil, flourishing in almost any situation, but never attaining a very large size in Massachusetts. It is a picturesque tree; the points of light from its white trunk producing a brilliant effect in the midst of its soft but glittering foliage, hanging, as we often see it, over some mountain stream, or sweeping up with a graceful curve from the side of its steep bank.

The recent shoots are of a reddish or purplish olive green, gradually deepening, in successive years, into a dark copper bronze, conspicuously dotted with grayish brown dots, and contrasting strikingly with the white trunk. The larger branches and upper part of the trunk, and portions of the lower, have often a red tinge, whence the tree has been sometimes mistaken for the red birch, which is not found quite so far north. The smooth white bark of the trunk may be easily separated into thin horizontal layers, of an orange color within. The lenticular dots of the twigs become, on the larger trunks, horizontal stripes of a yellowish brick or orange color, two or three inches long, and a line wide.

The leaves are alternate on the growing branches, and in pairs below, on tapering footstalks, of one quarter or one third of their length. They are from two to four inches long, and sometimes more than two wide, often inequilateral, broad, oblong-egg-shaped, inclining to heater-shaped, tapering to a point, irregularly, doubly and coarsely, but sharply serrate; smooth above, roughly reticulated beneath; dotted above and beneath, when young, with resinous, silvery dots, and downy about the axils of the veins beneath. They resemble the leaves of the common gray birch, but are broader towards the extremity.

The male flowers are in pendulous catkins, three or four inches long, with the scales very slightly fringed. The fertile catkins are longer than in the other birches, and have their

scales three-lobed at base, and also slightly ciliate. The stigmas are longer than in the white birch, and give the slenderaments a rougher appearance. When mature, the fertile catkins are cylindrical, an inch and a quarter or half long, pendulous on slender stalks half an inch in length. They are made up of imbricated, three-lobed scales, the middle lobe acute, the side lobes orbicular, enclosing three ovate seeds, with broad thin membranaceous wings and persistent stiles, resembling a winged insect with antennæ. The fruit, like that of the other birches, is full grown in July, at which time the male catkins of the next year begin to show themselves at the ends of the branches.

From the tough, incorruptible bark of the canoe birch, were formed the canoes of the former inhabitants of New England, models of ingenuity and taste, so admirably adapted, by their lightness and shape, to the interrupted navigation of the savage. Michaux has given an interesting account of the various uses of the bark:—

“ In Canada, and in the District of Maine, the country people place large pieces of it immediately below the shingles of the roof, to form a more impenetrable covering for their houses; baskets, boxes and portfolios are made of it, which are sometimes embroidered with silk of different colors; divided into very thin sheets, it forms a substitute for paper; and, placed between the soles of the shoes and in the crown of the hat, it is a defence against humidity. But the most important purpose to which it is applied, and one in which it is replaced by the bark of no other tree, is the construction of canoes. To procure proper pieces, the largest and smoothest trunks are selected: in the spring, two circular incisions are made several feet apart, and two longitudinal ones on opposite sides of the tree; after which, by introducing a wooden wedge, the bark is easily detached. These plates are usually ten or twelve feet long, and two feet nine inches broad. To form the canoe, they are stitched together with fibrous roots of the white spruce, about the size of a quill, which are deprived of the bark, split, and suppled in water. The seams are coated with resin of the Balm of Gilead. Great use is made of these canoes by the savages and by the French Canadians, in their long journeys into the interior of

the country : they are very light, and are easily transported on the shoulders from one lake or river to another, which is called the *portage*. A canoe calculated for four persons with their baggage, weighs from forty to fifty pounds ; some of them are made to carry fifteen passengers."—*Michaux, Sylva*, II, p. 87.

"In the settlements of the Hudson's Bay Company, tents are made of the bark of this tree, which, for that purpose, is cut into pieces twelve feet long and four feet wide. These are sewed together by threads made of the white spruce roots, already mentioned ; and so rapidly is a tent put up, that a circular one of twenty feet in diameter, and ten feet high, does not occupy more than half an hour in pitching. The utility of these 'rind tents,' as they are called, is acknowledged by every traveller and hunter in the Canadas. They are used throughout the whole year ; but, during the hot months of June, July, and August, they are found particularly comfortable."—*Loudon, Arb.* III, p. 1709.

This birch, in some parts of the northern regions, attains a diameter of six or seven feet. It is said not to occur far south of the Hudson.

The heart-wood of the canoe birch has a reddish hue. The sap-wood is beautifully white. It is soft, smooth, takes a fine polish, with a pearly lustre, and is therefore fitted for ornamental works. But it is perishable, when exposed to alternations of moisture, and not remarkable for strength. A canoe birch cut in summer and kept constantly from the weather, is very durable, and becomes very hard. I have seen studs made of it nearly forty years old, entirely free from decay. It is used in the manufacture of chairs, and in other cabinet work. A portion taken from a part of the trunk from which a large branch issues, makes a beautifully feathered and variegated surface for the front of a bureau, or for a table. It is also used for hat-blocks, and for many uses of the turner.

Formerly, when large old trees of this species were more common, the bark was used in the manner described above by Michaux being placed beneath the shingles. Many old buildings in the back parts of New England are still found covered in this way. Carefully laid, it makes a covering impenetrable to rain,

and a most effectual screen against heat and cold; and it is almost imperishable.

Sp. 5. THE WHITE BIRCH. *B. populifolia*. Aiton.

Leaves and strobile figured by Michaux, Sylva, II, Plate 71; the tree, leaves and aments, by Loudon, Arboretum, VII, Plate 235.

The white birch, or the little gray birch, as it is often more descriptively called, can be mistaken for no other tree except the canoe birch, from which it is distinguished by the grayish color and chalky surface of its harder bark, and by the marked triangular form of its leaf, which tapers to a very long, slender point. It is a tree of third rate, never, so far as I have seen, even in the most favorable situations, attaining the height of forty feet, and usually not over twenty-five or thirty. One of the largest I have ever seen measured four feet and two inches in girth at the ground, and two feet eight inches at three feet above. It is, in many parts of New England, beyond whose limits it is not known to extend far, southward or northward, the most common companion of the pitch pine, in the poorest sandy soils. But, independently of its associations with sterility, which it is well entitled to, as it springs up and grows rapidly in spots deserted by every other deciduous tree,—it is a graceful and beautiful object, enjoying, in an eminent degree, the lightness and airiness of the birch family, and spreading out its glistening leaves on the ends of a very slender and often pensile spray, with an indescribable softness. So that Coleridge might have called it, as he did the corresponding European species,

—————“most beautiful
Of forest trees—the lady of the woods.”

It often makes a striking appearance at a little distance, from its delicate and elegantly cut, feathery foliage, and the strong contrast between the white trunk and the black branches, and the bright speckles of the sun's light thrown back from the glossy leaves.

The stem is erect, or more usually ascending, clothed with a chalky white or grayish white bark, with a triangular dusky

space below the branches. The branches are numerous and small, of a very dark purple, looking black at a distance, in contrast with the white trunk, and conspicuously spotted with oval, horizontal, gray dots. The recent shoots are brown, closely dotted with round dots, and, in the next year, often scattered with white scales. The leaves are on long slender footstalks, triangular or heater-shaped, rounded or right-angled, or heart-shaped at base, ending in a long tapering point, irregularly toothed, the larger teeth having an abrupt sharp point, shining on both surfaces, and glutinous when young. In autumn, they fade to a rich yellow.

The male flowers are on cylindrical, brownish-yellow, pendulous catkins, usually single at the end of the branches, three inches long. The larger scale is shield-like, the next two rounded, the inner three inversely egg-shaped, all fringed; the former three brown, the latter yellowish. The fertile flowers are in smaller and more slender, erect, lateral catkins, with green scales. The stigmas are shorter than in the other species, and the catkins thence look smoother. When mature, the ament becomes a cylindrical strobile, an inch or more long, and two or three eighths thick, on a footstalk three eighths of an inch long.

The white birch is valuable for the rapidity with which it grows on any kind of soil, or even without soil. It makes a pleasant border for the road,—infinitely better than none. I have found myself sensibly relieved, in a walk on a sunny afternoon, by the thin shade of low dwarf birches, which had sprung up by the road side. In twelve or fourteen years, it grows to its usual height of twenty or twenty-five feet, and in this way better than in any other, can a profit be derived from otherwise useless land. It makes tolerable fuel, less valuable doubtless than the wood of most other deciduous trees, and ranking with that of the evergreens, but answering well, for the common purposes of the kitchen, for more than half the year. But it grows on poor land, where scarcely any thing else will, and on good land in a shorter time than any other tree, as on good land it may be advantageously cut every ten years. It makes a valuable coal for smiths.

All the birch trees, especially the black and the white, are so

valuable for timber and for fuel, that their cultivation should be earnestly recommended. They flourish on all kinds of soil, even the poorest, spring most readily from seed, and grow very rapidly. I therefore give, from Loudon's Arboretum, two modes of propagating them, as practised in England, and on the continent of Europe. The directions have reference to the European birch, *betula alba*, but from the intimate resemblance of the trees of the same family, will doubtless apply to our native birches. Indeed, Dr. Hooker says that, judging from the specimens of the little white birch which have been sent to him from this country, he cannot see how it differs, except in unimportant particulars, from the white birch of Europe.

“Birch seed ripens in September and October; and may be either gathered and sown immediately, or preserved in a dry loft, and sown in spring. Sang directs particular attention to be paid to gathering the seeds only from weeping trees; and this we know to be the direction given to the collectors employed by the nurserymen in the north of Scotland. If the seeds are to be sown immediately, the catkins may be gathered wet; but, if they are to be kept till spring, they ought not to be gathered except when quite dry; and every day's gathering should be carried to a dry loft and spread out thinly, as they are very apt to heat when kept in sacks, or laid up in heaps. The seeds should be sown in very fine, light, rich soil, in beds of the usual width, and very slightly covered. Boucher says:—‘Sow the seeds and clap them into the ground with the back of the spade, without any earth spread over them, and throw a little peas haulm over the beds for three or four weeks, till the seeds begin to vegetate. The peas haulm will keep the ground moist, exclude frost, and prevent the birds from destroying the seeds.’ (*Treat. on Forest Trees*, p. 113.) ‘It is scarcely possible,’ Sang observes, ‘to cover birch seeds too little, if they be covered at all.’ The plants, if sown in autumn, will come up in the March or April following. If sown in spring, they will come up in May or June; which, in very cold climates, is a preferable season. If any danger is apprehended from moisture in the soil during winter, the alleys between the beds may be deepened, so as to act as drains. In the nursery lines, the plants

require very little pruning, and their after-care, when in plantations, is equally simple.

“Young birch plants which have been pulled out of coppice woods, when about two years old, are found to root much better than seedlings of the same age and size taken out of a regular seed-bed; doubtless because, in the latter case, a greater proportion of the taproot requires to be cut off. In the case of the young birches pulled out of the copses, the taproot, which could not get far down into the hard soil, has its substance in a more concentrated form, and is more branching; hence, little requires to be cut off it, except the ragged rootlets, or fibres; and it may be considered as acting as a bulb to the upper part of the plant. The tops of these seedling birches are shortened before planting; and the plants, Mr. Young informs us, make as much wood in one year as regular nursery-reared birch seedlings will in two.”

“In France and Germany, plantations of birch are frequently made by sowing the seed where the trees are intended finally to remain. For this purpose, the poorest soils are harrowed in humid weather, in the month of October, or of November, and fifteen pounds of seed, as it is taken from the catkins along with the scales, is sown on an acre, and afterwards covered with a bush harrow. Where the ground is under corn, the seed is sown with the last corn crop, as clover is in England; and, where it abounds with weeds and bushes, these are set fire to, early in the autumn, and the seed sown as soon afterwards as it is gathered from the trees. It is observed by Michaux, that burnt soil is peculiarly favorable to the growth of the birch, which in America reappears, as if by enchantment, in forests that have been burnt down.”—*Loudon*, p. 1702.

Sp. 6. THE DWARF BIRCH. *B. Glandulosa*. Michaux.

The dwarf birch is a handsome little shrub, not above two feet high, which is found far north, on Hudson's Bay, and in mountainous regions as far south as New Jersey and Pennsylvania. It is found in a few places in this State, in wet meadows, on or by the side of mountains.

V. 2. THE ALDER. *ALNUS*. Tournefort.

The alders are trees or tall shrubs, natives of the cooler regions of the northern hemisphere, and, in a few instances, of the mountains of tropical America and of Central Asia. They have alternate, entire, deciduous leaves, and stalked buds, in which the leaves, plaited and folded together, are protected by a single scale. The aments are on branched stalks, the male, long, cylindrical and pendulous; the female, short, ovoid and erect. The scales of the sterile aments are on stalks, with usually five smaller, accessory scales, and three-flowered. The flower-cup is four-parted and has four stamens. The scales of the fertile ament are wedge-shaped, fleshy, and persistent; the ovary compressed, with two long stigmas. The strobile consists of woody scales grown together. The seed-vessel or pericarp is compressed, angular, woody, not winged, one-celled and one-seeded.

The roots of the alders are large and strong, extending somewhat beneath the surface, with few radicles, and usually throwing up, near the stem, many suckers. They are covered with a thin, dark orange bark.

The wood is soft, somewhat tenacious, and durable under water. It is, almost universally, of a reddish or pale rose color. The bark is thin and parts easily from the wood when the sap is rising. The wood and the bark of the species found on the Eastern continent are extensively used for dyeing and for tanning, as the bark abounds in tannin.

The alder usually occurs along streams, and performs an important office in protecting their banks from the running water. It may be readily propagated by layers, by cuttings, by truncheons, or by seed.

There are two species in Massachusetts :

The Common Alder, remarkable for the glossy and often glutinous surface of the leaves, and for their being larger towards the end and rounded at the extremity; and

The Speckled, with large leaves, which are pretty thick, and have their lower surface downy or bluish white, or rarely green.

Sp. 1. THE COMMON ALDER. *A. serrulàta*. Willdenow.

Figured in Michaux, Sylva, II, Plate 75, a leaf which is found, but is not characteristic of the species. Faithfully represented in Abbott's Insects of Georgia, II, Plate 92, with the American Alder Dagger Moth, whose caterpillar feeds on the leaves.

The common alder is a shrub or small tree, abounding along brooks and in swamps, rarely erect, but bending upwards. The branches are flexuose; when young, smooth or sometimes downy, and dotted with gray or orange oblong dots, brownish green, becoming afterwards a grayish or even a dark bottle green, with the dots longer and horizontal, and often sprinkled with a grayish dust, and here and there a thin lichen.

The leaves are alternate, on short, dotted, scaly footstalks, oval or obovate, rounded or somewhat acute or wedge-shaped at base, rounded or with a blunt point at the extremity, irregularly and slightly serrate, smooth and shining, with resinous dots, which on the young leaves are glutinous; they are sometimes sprinkled with white scales, and impressed at the veins above; on the under surface they are paler and shining, with the larger veins prominent, and with the veins downy while young, but at last nearly smooth, and with a tuft of down at the axils. They are coriaceous in texture, and from two and a half to four and a half inches long, and one and a half to three inches broad. The stipules form a purse enclosing the unexpanded leaf. They are yellowish green, coriaceous, broad-oval, rounded, half as long as the footstalk or more, falling off when two or three leaves above are expanded.

The flowers of the alder are among the earliest harbingers of spring. The aments, which had begun to appear towards the latter end of summer, had been perfectly formed before the close of autumn, and had so remained, unprotected, during winter, feel the first warmth, and expand early in April or even in the last days of March. The aments of the male flowers are from one to three inches long, beautiful tassels of purple and gold, in clusters of three, four, or five together, on short, branching, terminal footstalks. They are composed of a central stem or rachis, to which are attached brown or purple, heart-shaped or

rhomboidal scales on short footstalks. Beneath each scale are three smaller ones containing each a four-lobed flower-cup with four stamens, from whose anthers issues a cloud of pollen. The abundance of this golden colored dust gives its rich hue to the pale yellow flower.

The footstalks of the male and female aments part usually from the same point; the male hang downwards; the female stand erect and seem to be terminal. The fertile aments are ovate-oblong, one fourth or one third of an inch long, of a deep purple, bristling, when in flower, with the prominent scarlet styles. They afterwards enlarge to one third or one half an inch in length, become very hard, and remain through the winter on the tree, showing a distant relationship to the pines. Some of the scales of the ament often become excessively lengthened, leaf-like or rather like the stipules, bristling on the mature catkins, and at last turning black and hard.*

The wood is white, rapidly becoming orange or of the color of Russia leather, on exposure to light.

In some countries, the alder has been planted for a purpose which it usually subserves without the aid of art, on the borders of rivers and small streams. The matted roots give stability to the banks of soft earth, and keep the stream within its bounds, while the stems, overhanging the water, beautifully fringe the meadows through which it flows.

The common alder is too small a tree to be much used for its wood, except as fuel, as it seldom grows more than twelve or fourteen feet high and two or three inches in diameter, though rarely, in deep swamps, it is found six or eight inches thick, and twenty or thirty feet high. It makes excellent fuel, burning readily and throwing out much heat. It is preferred to any other tree, for making charcoal to be used in the manufacture of gunpowder. It is also employed for the hoops of small casks, such as are used to contain nails or gunpowder. There are many uses to which it might be put, as its close resemblance to the common alder of Europe indicates an identity of properties.

* The alders have not been attentively studied by writers upon American botany. Pursh's descriptions seem to me of no value. The expression "*amentis junioribus cylindraceis, fructiferis ovalibus*" would apply equally well to all the species. I doubt whether an important distinction can be found in the stipules.

"In Scotland, the leaves of that alder have been used to tan leather and as food for sheep, and in France as winter food for cattle. Ulcers have been healed by them, and a decoction has been found efficacious in the cure of sore throats. The bark, which is astringent, is used by fishermen to stain their nets; with copperas it forms a black dye, and, when concentrated, an ink; and it is used by the Laplanders to stain their shoes, girdles, and other articles of skin."—*Flora Londinensis*, Art. *Alnus*.

"The bark on the young wood, and the wood itself, is used for tanning, and the young shoots to die red, yellow and green."—*Loudon*.

Sp. 2. THE SPECKLED ALDER. *A. incana*. Willdenow.

The leaf of the glaucous variety is figured in Michaux, II, Plate 75, figure 2.

This alder is found in every part of Massachusetts, and in Maine and New Hampshire.

The recent shoots and fruit-stalks are brown and downy, dotted with orange dots. They gradually become of an ashen or grayish brown where exposed to light, and on the larger branches and trunk, in the shade, the bark is of a reddish or bottle-green color, speckled with conspicuous light gray dots, whence its common name of speckled alder. The stem is usually eight or ten feet high and from one to three inches in diameter, but it is sometimes much larger and higher,—twenty feet high and five or six inches in diameter.

The leaves are from three to five inches long and two to four inches wide, broad oval, rounded or somewhat cordate at base, pointed at the end, doubly serrate or denticulate-serrate, (each of the larger veins usually forming a tooth with several serratures between,) smooth and conspicuously impressed at the veins and veinlets above; of a soft coriaceous texture; covered with abundant, soft, often ferruginous pubescence beneath, with the veins and veinlets strikingly prominent. The opening leaves are very downy. The footstalk stout, half an inch long, and downy. Stipules lanceolate, downy, as long as the footstalk, soon falling.

The speckled alder is easily distinguished by the brilliant, polished, reddish green color of its stem-bark, and the size, regularity, impressed reticulations and the downy under surface of

the leaves. The branchlets, at the time of flowering, are dependent, and the long, pendulous, sterile catkins are thus terminal, while the ovate fertile ones are on shorter, lateral footstalks just above. This is the reverse of the arrangement of the catkins in the common alder, in which the fertile aments, being erect, seem terminal, while the sterile ones bend down. The sterile aments are from one to three inches long, of an orange and brown color, more slender and tapering than those of the common alder. The fertile aments are cylindrical, smaller than those of the common, and pointing downwards.

This alder is found in the same situations and soil as the common, and seems to have similar properties.

A striking and very beautiful variety of the speckled alder, called the glaucous alder by the younger Michaux, is distinguished by the pale blue or glaucous color of the lower surface of the leaves. The pubescence is less abundant, but the veins and footstalk are often, as in the common form of the tree, of a rusty color. Michaux says that the glaucous alder sometimes becomes a tree of eighteen or twenty feet in height. He considers it a distinct species and the most beautiful of the alders.

There is a variety intermediate between the common and the glaucous alder, and more near to the latter. The leaves are oblong, doubly serrate, and distinctly pointed, rounded or acute at base, the veins slightly hairy or smooth, and the axils hairy. The young branches are brownish. It differs from the common alder in its leaves being always acute and never obovate, and from the speckled, in having its leaves shining and free from down. The leaves vary extremely in their proportions, being sometimes three or four inches long, and one and a half inches broad, tapering at both extremities; and sometimes four or four and a half inches long and three and a half broad. They are thinner and less leathery than those of the others. The fertile aments are on much branched footstalks, often as many as twelve together.

The general aspect of this alder is similar to that of the speckled alder, differing in the greenness of the under surface of the leaves. It grows in similar situations, and is often ten or twelve feet high.

FAMILY VI. THE WAX MYRTLE FAMILY. *MYRICACEÆ*.

LINDLEY.

A family of about thirty species of leafy, aromatic shrubs with resinous glands and dots, and alternate, simple, entire leaves, found in all climates. It has a near affinity to the birch family, differing in its ovaries having only one cell, and in the character of its leaves. Some species produce eatable and agreeably acidulous fruits; the greater part have their fruit covered with tubercles of a resinous substance similar to wax. The species found in this country are low, fragrant shrubs, remarkable for their tonic, aromatic, and astringent properties. The male and female aments are on the same or on distinct plants; the male, cylindrical or thread-like, formed of bract-like scales, with from two to eight stamens in each flower; the female, ovate, sessile, densely imbricate; with ovaries one-celled, and containing one ovule, with two, long, thread-like stigmas. The fruit is a drupaceous, one-seeded nut.

We have two genera, the Myrtle, distinguished by its resinous or waxy berries; and the Sweet Fern, by its globular, compound fruit, with shining nuts set in bristling scales.

VI. 1. THE MYRTLE. *MYRICA*. L.

Male and female flowers on distinct plants. Scales of the aments crescent-shaped. Stamens four. Fruit drupaceous. Leaves wedge-lance-shaped.

Sp. 1. THE SWEET GALE. DUTCH MYRTLE. *Myrica gale*. L.

A dark-looking bush from two to five feet high, growing in places which are inundated through a part of the year, and forming large, close-tangled patches or islets.

The branches and upper part of the stem are of a rich dark purple color, polished and shining. On older stems and lower, the outer bark cracks and rolls horizontally, becoming rough and of a lighter color, but still somewhat shining, giving the

plant a resemblance to a black birch in miniature. The roots are somewhat matted together, and extend to some distance.

The leaves are from three to six fourths of an inch in length, and usually less than half an inch wide, wedge-lance-shaped, with a few serratures towards the extremity, which is commonly a little pointed; downy on the veins beneath, and sprinkled with minute, yellow, resinous dots on both surfaces.

Towards the end of summer, the next year's aments are formed in the axils of the upper leaves, in the shape of short, ovoid, pointed, scaly buds. The male and female flowers are on separate plants. The male are in catkins an inch or more long, in twos or threes at the end of the branches. They are made up of heart-shaped, purple scales, loosely arranged on an axis. Each scale rests on a short footstalk, is striated within, has a membranous border, and is set, towards the base without, with numerous, amber-colored resinous dots. Stamens about four, at the base of the scale; the anthers are short, large, opening with four valves.

The fertile flowers are in ovoid catkins about a line in length, imbricate with triangular scales, from behind which appear the purple, tapering, thread-like, bifid stigmas. When mature, the compound fruit is in short, cylindrical aments three or four lines long and three wide, sometimes solitary, but commonly in groups of two to six at the end of a short branch. It is made up of ovaries surmounted by the withering styles and compressed between two swollen, fleshy, three-sided, pointed scales, abundantly sprinkled with yellow resinous dots.

When crushed, the leaves feel somewhat resinous, and exhale a strong, penetrating, rather unpleasant odor. They are often placed in drawers for the purpose of keeping out moths.

The young buds, Dr. Richardson says, are used by the Indians in Canada, to dye their porcupine's quills. This plant is found in Labrador and Newfoundland, and as far as Fort Norman on the Mackenzie River. It is also found in Connecticut, Pennsylvania and Virginia.

Sp. 2. THE BAY BERRY. WAX MYRTLE. *Myrica cerifera*. L.

Figured in Bigelow's American Medical Botany, III, Plate 43.

This is a crooked shrub, found growing in interrupted, miniature forests, in every variety of situation and soil; from dry, rocky hills to sandy plains and the borders of marshes. It is from two to six or seven feet high, very irregular, rarely erect, giving off crooked or angled, rough branches, in bunches of three or four. The bark is brownish gray, with clouds of a lighter hue, dotted with round, or oblong, horizontal, white dots. The leaves are irregularly scattered, often crowded or tufted, nearly sessile, obovate, lance-shaped, abruptly pointed, wedge-shaped at base, wavy, entire or with a few serratures, sometimes revolute on the edge, and whiter and sprinkled with yellowish dots beneath. The barren flowers, which expand with the leaves in May, are in stiff, erect catkins, less than an inch long, on the sides of the last year's branches. The scales are roundish or rhomboidal, somewhat loosely arranged, and contain each three or four stamens, often partially united by twos, and surmounted by anthers divided to their base. The catkins of the fertile flowers, which are on a different plant, are much smaller, erect, made up of imbricated, oval, pointed scales, containing an ovary surmounted by two prominent, awl-shaped stigmas. On each matured ament are from four to nine, dry, waxy berries or drupes, on very short footstalks. They are at first green, afterwards blackish, and finally white, consisting of a stone covered with black grains invested with wax. The fruit-stalks continue to the second or third year, twelve or more arranged spirally on a shoot. The berries, leaves and recent shoots are fragrant with a balsamic odor which seems to come from the minute, transparent, yellow dots with which the recent shoots and under surface of the leaves are sprinkled. The roots are large and somewhat spreading.

The wax is obtained by boiling the berries in water. It rises to the surface and hardens on cooling. About one third part of the weight of the berries consists of wax. In Nova Scotia, this wax is used extensively, instead of tallow, or mixed with

tallow, to make candles. It has sometimes, also, been mixed with beeswax for the same purpose. Candles made of it diffuse a very agreeable perfume, but give a less brilliant light than those made entirely of animal substance. The wax of the bay berry is also made into hard soap with the ley of wood ashes, lime, and common salt; one pound of wax being sufficient for ten pounds of soap, and taking the place of the animal or vegetable oils used in the manufacture of common soaps. A decoction of the root has been sometimes used as a remedy for dysentery.

VI. 2. THE LIQUIDAMBER. *COMPTONIA*. BANKS.

Low shrubs with fragrant leaves, fern-like, long, slender, narrow, and deeply cut on both sides into roundish lobes, and globular, compound, bristly, bur-like fruits, with roundish, smooth nuts. There is a single species:

THE SWEET FERN. *Comptonia asplenifolia*. Aiton.

A fragrant, round-headed bush, about two feet high, abounding on hill sides and in the openings in woods. It has the appearance of a miniature tree. The recent shoots are green or of a yellowish or reddish brown, somewhat downy, and sprinkled, as are the leaves and stipules on both surfaces, and the older branches towards the extremities, with minute, yellow, shining, resinous dots. The branches of a year's growth are yellowish brown, with a polished, shining surface, somewhat hairy. The lower ones curve down and then upwards, forming an inverted arch. The older ones are reddish purple or coppery brown, rather rough, and closely dotted with raised, brown dots. The roots are long and creeping, and throw up numerous stems.

The leaves are nearly sessile, very long and narrow, from one to six inches long, and less than one inch wide, pointed, cut into large, obtuse-angled teeth, by indentations reaching nearly to the mid-rib, dark green, impressed at the veins above, paler and downy on the mid-rib and veins beneath; with the margin somewhat reflexed. The stipules are half an inch long, lanceolate, acuminate, auriculate, or half-arrow-shaped, and often

accompanied by an additional pair of smaller stipules below. The buds are small and roundish.

The barren aments are crowded towards the ends of the branches, in the axil of the sometimes persistent leaves of the last year. They are erect, about half an inch long, composed of brownish, hairy, pointed, kidney-shaped scales, closely investing each other in spiral lines.

The fertile aments are globular and bur-like, less than an inch in diameter, with a few ovate, smooth, shining, dark brown nuts, set among rough, narrow, awl-shaped, bristly scales.

The whole plant gives out a pleasant, spicy odor. This is stronger and somewhat different when the leaves are crushed. They are a common ingredient in diet drinks, and an infusion is a popular remedy for dysentery.

Dr. Richardson found the sweet fern in New Brunswick and in Canada as far as the Saskatchewan. It occurs abundantly throughout the New England and Middle States, and on the mountains of Carolina and Georgia.

FAMILY VII. THE PLANE TREE FAMILY. *PLATANACEÆ*.

LINDLEY.

The family of the plane trees comprehends some of the loftiest and largest deciduous trees of the northern temperate zone. They are distinguished for their broad leaves, globular inflorescence and fruit, and the absence of milk in leaves, fruit, wood and bark. In some parts of the old continent, they are valued for their timber, and have been, from ancient times, most highly esteemed for their shade. The leaf-buds are enclosed in the leaf-stalk, whence the planes are necessarily deciduous, the expansion of the buds forcing the previous leaves from their articulation. The layers of bark have little mutual adherence, and are deficient in toughness and extensibility; the outer layers are therefore liable to fall off in large irregular patches. The roots are long and running. By some writers the plane

trees are considered as belonging to the Bread Fruit Family, with which they have many points of resemblance.

The planes are natives of the Levant, Barbary, and North America. The bark has some astringency, the leaves have been used in fomentations, and were formerly considered an antidote to the bite of serpents.

THE PLANE TREE. *PLATANUS*. L.

This is a genus, the only one of the family, of lofty trees, with broad, spreading branches, and large leaves, forming a dense foliage. The young shoots, leaves, and stipules are thickly covered with fine down, which, as they expand, falls off, and floating in the atmosphere, is liable to be inhaled by persons in their vicinity. This produces a disagreeable cough, sometimes of considerable duration; and the circumstance forms a strong objection to planting these trees in the neighborhood of dwelling-houses.

Two species, the Occidental Plane, and the Californian, are found within the territory of the United States, a third, the Oriental, is generally diffused on the eastern continent, and two others, possibly varieties of this, occur in the extreme east. The only one native to Massachusetts is

THE BUTTONWOOD TREE. *Platanus occidentalis*. L.

Figured in Michaux, Sylva, II, Plate 63; in Catesby's Carolina, Plate 56.

The tree is represented, as seen in winter, in Loudon, Arb., VIII, Plate 289.

The leaves are figured, together with the beautiful Plane Tree Moth, whose caterpillar lives on them, by Abbott, II, Plate 55; and by Audubon, with the Summer Duck; Birds of America, III, Plate 206.

At a place called Vacluse, some miles from Newport, on the island of Rhode Island, on an estate formerly belonging to Samuel Elam, a man of taste and of humanity, there was standing, in September, 1839, on the side of a small stream, a buttonwood tree, which measured at one foot from the surface of the ground, twenty-four feet four inches. The thickness of the tree and the declivity of the bank, made the ground two feet and a half higher on one side than on the other, so that this measure was

three feet and a half from the ground on the lower side. Four feet higher, it measured twenty-one feet four inches. At ten or twelve feet it divided into two trunks which rose, parallel, to the height of not less than one hundred feet. In some aspects, it looked at a distance like a tree with one undivided trunk; in others, like two trees. Many moderately large branches thrown out far from the ground, gave it a long, cylindrical head. The root covered the ground from four to eight feet on all sides of the trunk. In this horizontal pavement, some openings indicated decay, but in every other respect, the tree had the appearance of perfect vigor.*

I fear that tree may not be now alive, as many of the finest plane trees have perished within a few years; if it is still standing, it is one of the most remarkable, for size and loftiness, in New England. Few trees are left of such gigantic dimensions as this. But still the plane is the largest, grandest, and loftiest deciduous tree in America. It has a magnificent columnar trunk. For a short distance from the ground it diminishes with a rapid, but regular curve, which gives it a base of vast stability; thence with a scarcely perceptible taper, a shaft rises high in the air, bearing its light green top aloft, above the summit of the other trees of the forest. The trunk presents a great variety of appearance. Rarely, it is seen with an ashen gray bark cracked and rough, like other trees. But the bark has very

* This horizontal expansion at the base is common in the plane tree of Europe. Olivier, speaking of the great plane tree of Buyuk-déré, a valley on the Dardanelles, six miles from the Black Sea, says—"Seven or eight trees, of an enormous size, adhering at their base, rise circularly, and leave in the middle a considerable space. A great many Greeks and Armenians were seated on the turf, in the shade of these trees, smoking their pipes. Several Turks were in the enclosure of the plane tree, smoking their pipes and drinking coffee."

"The plane tree often presents at its base a considerable expansion of a diameter double or triple that of the trunk, and which may exceed thirty feet, as we have sometimes seen, so that it frequently happens when the tree dies of age, that it sends forth, all round the stump, shoots which form so many new trees; this, no doubt, is what has happened to the plane tree of Buyuk-déré. We remarked, indeed, that the seven or eight trunks of which it is formed, appear to have a common origin, and that they are all connected by their base."—*Travels in the Ottoman Empire, Egypt, and Persia*. By G. A. Olivier, London, 1801. Vol. I, pp. 114, 115.

little toughness, and usually, on the stem and larger branches, flakes off in broad, irregular scales, leaving portions of the inner layers, of a light yellowish color, exposed. These bright patches, seen among the green leaves, or on the uniform gray of the stem, produce often a striking effect. Sometimes the upper part of the trunk is seen quite smooth, but of different colors, as there is no regularity in the period or extent of the exfoliation of the bark. Sometimes the trunk is uniform and rough, with unequal roundish scales, while the limbs are smooth and mottled.

“No tree,” says Gilpin,* “forms a more pleasing shade than the occidental plane. It is full leafed, and its leaf is large, smooth, of a fine texture, and seldom injured by insects. Its lower branches, shooting horizontally, soon take a direction to the ground; and the spray seems more sedulous than that of any tree we have, by twisting about in various forms, to fill up every little vacuity with shade. At the same time, it must be owned, the twisting of its branches is a disadvantage to this tree, as it is to the beech, when it is stripped of its leaves and reduced to a skeleton. It has not the natural appearance which the spray of the oak, and that of many other trees, discovers in winter. Nor indeed does its foliage, from the largeness of the leaf and the mode of its growth, make the most picturesque appearance in summer.

“The oriental plane is a tree nearly of the same kind, only its leaf is more palmated, nor has it so great a disposition to overshadow the ground, as the occidental plane: at least I never saw any in our climate form so noble a shade, though in the East it is esteemed among the most shady, and most magnificent of trees.”

The recent shoots are overspread with a copious grayish down, which they lose, in the course of the first season, except about the nodes or joints, and become of a grayish purple, or chestnut brown. The next year they are smooth and of a greenish gray, thickly scattered with minute gray dots. The green tinge gradually fades, and they assume a uniform light gray or yellowish color, almost white, as seen from a distance. The

* Forest Scenery, I, 109—10.

leaves are on stout footstalks, which are two or three inches long, very downy and grayish green at first, but becoming nearly smooth and purple. At the base of the leaf, the footstalk subdivides by throwing out two opposite ribs, nearly as large and long as the mid-rib, each of which has a large branch below, dividing the leaf into five imperfect lobes, and giving it a pentagonal outline. The ribs and veins are very prominent on the under surface, and each terminates in a large tooth. When freshly expanded, the leaves are profusely covered with a cottony down, which gradually disappears, and in autumn the upper surface is perfectly smooth, and of a light yellowish green; the under surface is lighter and still covered with down along the prominent purple ribs and veins. A striking feature in the appearance of the buttonwood is formed by the very large, conspicuous, and persistent stipules, with which every growing branch is garnished. These are always leaf-like, sometimes distinct, one on each side of the base of each leafstalk, oftener grown together, forming a complete ruffle, encircling and more than encircling the branch, and embracing it with a sort of sheath. When distinct, they are two or three inches long, an inch and a half broad, pointed, and, like the leaves, conspicuously toothed. When grown together, they look like a leaf whose extreme point is on the side of the branch opposite the leaf of which they are an appendage. Above them, especially at the base of a branchlet, is often found an additional pair of lance-shaped stipules, or a single one, two or three inches long. Both these kinds of stipules are, on the vigorous shoots, particularly on the sprouts from the stole or root, more lasting than the leaves, not being pushed off, like them, by the growth of the buds. The leaves are usually five or six inches long, and seven or eight broad, but they are often much larger. Before falling, they turn usually to a pale yellow.

The buds are short, broad, pyramidal, rounded at the tip, and of a chestnut brown, when they have been a little while exposed. They are enveloped by several gummy scales, and, in their early stage, enclosed in the footstalk of the leaf, which is therefore necessarily deciduous. Each bud and the base of each branchlet is accordingly surrounded by the scar of a fallen leaf,

and the branchlet is encircled at that point by a ridge formed by the scar of the pair of stipules; whence the smaller branches have a jointed appearance.

The female catkins are a globular ball, five eighths of an inch in diameter, at the end of a flexible, downy footstalk, which is from two to five inches long, and one-eighth of an inch in diameter. The styles are in twos—or, if double, cleft to the base, completely investing the ball, close-set, swelling and hairy at base, tapering, green, with a small, declined head, and a reddish, glandular fringe on one edge as a stigma.

The young leaves are accompanied by a pair of short, brownish, sheathing, scale-like, deciduous stipules, and, with their footstalks, are covered with a thick cottony down.

The male catkins are on slender, tapering, dusty threads, one or two inches long. They are one quarter of an inch in diameter, and are invested by numberless stamens, completely in contact, each consisting of two cells, opening at the sides, white, and pouring out white pollen, and surmounted by a brownish green, glandular disk, forming together the surface of the ball. The footstalks of the catkins have stipules at base, like those of the leaves, but smaller; those of the female often having one or two miniature leaves, and a peculiar auricular appendage towards the base, as if they were abortive branches.

In most parts of New England, this tree is called buttonwood by the common people. Sycamore is a name often given to it; and it is sometimes called the plane tree. In England it is called the occidental plane to distinguish it from the European, which is called the oriental. There is no propriety in calling it sycamore, as that name indicates a totally different tree. Plane tree or platane is classical; but buttonwood is the good, English, descriptive name which belongs to it.

According to Michaux, this tree is found as far north as Montreal, in Canada, where it is called by the French the cotton tree. Along the coast, I have found it in the county of York, in Maine. Its range southward is beyond the Mississippi, and in longitude from the Atlantic, through the extreme Western States. It flourishes best on a deep, loose, rich soil,

in a cool, moist situation; and it is nowhere more vigorous than along the rivers of Pennsylvania and Virginia, and especially on the Ohio and its tributaries. The elder Michaux measured a buttonwood growing on a little island in the Ohio, fifteen miles above the mouth of the Muskingum, and found its girth, at five feet from the ground, to be forty feet four inches. General Washington had measured the same tree twenty years before, and found it to be of nearly the same size. In 1802, the younger Michaux and his companions, found a large tree of this kind on the right bank of the Ohio, thirty-six miles from Marietta. Its base was swollen in an extraordinary manner, but, at four feet from the ground, its circumference was found to be forty-seven feet.

The buttonwood is remarkable for the rapidity of its growth, especially when standing near water. Loudon mentions one which, standing near a pond, had, in twenty years, attained the height of eighty feet, with a trunk eight feet in circumference at three feet from the ground, and a head of the diameter of forty-eight feet. The buttonwood has been cultivated in England more than two hundred years, having been introduced about 1630. In 1809, it had become more common than the oriental plane, but in May of that year a severe frost is supposed to have killed the young shoots of many of the largest trees of this species throughout the Island. In Scotland, where trees of both species were growing near each other, the oriental escaped, while the occidental were generally injured. Many died that year or in the summer of 1810, after making an ineffectual effort to push their leaves. According to the observation of Lang, only the large trees perished. But the severe winter of 1813—14, destroyed many of those which had escaped in 1809.

It seems very doubtful, from the account given of this malady, whether it is referred to its true cause. Lang says, "Trees from twenty to twenty-five feet in height were little hurt; and smaller ones not at all." This looks very little like the action of frost.

The buttonwoods, throughout New England, were affected in a similar manner, but less severely, in the springs of 1842,

'43 and '44. The shoots seemed to have been nipped as by a frost. The large trees were particularly affected, but by no means exclusively. For some weeks, in each of these springs, many of the trees seemed to have been killed. In the course of the summers, most of them have pushed forth leaves on the sides of the branches, and have seemed partially recovering. The extremities of the branches, on almost all the buttonwoods, are dead, and many of the trees are now, in the fall of 1845, completely so.

This malady has been attributed to various causes. By most persons, it is considered the effect of frost. Others ascribe it to the action of some insect or worm; and others believe it to be some unaccountable disease.

It seems to me most probable that it is owing to the tree's not maturing its wood during the previous summer, so that it is incapable of resisting the cold of winter. The present season, of 1845, has been a remarkably warm one, and this year, if ever, the buttonwood must have had time to mature its wood. If the wood formed during the present season should not be affected by the cold of the spring of 1846, some confirmation will be given to this conjecture.

Very little use in the arts is made of the wood of the plane tree. It is very perishable when exposed to the weather; it is said to warp considerably, and in every valuable property is thought to be surpassed by other kinds of timber equally abundant and accessible. For some purposes of ornament, however, it would seem to present claims to attention. The roots, according to Michaux, have a beautifully red color, when taken from the earth, but lose it on exposure to the light. Means might doubtless be found to make this color permanent. The wood of the stem is hard, of a firm and close texture, of an agreeable, faint red color, and beautifully varied by close lines of silver grain. There is every reason to believe that it is as valuable as that of the oriental plane, and that the great excellence and variety of our timber trees have alone prevented the necessity of its use.

S. W. Pomeroy, Esq., in an article in the fifth volume of the *New England Farmer*, urges the cultivation of the buttonwood.

He says it may be propagated with more ease than any tree of the forest, and the speedy returns of fuel it will make, lead him to believe that its cultivation would become general, if its value were duly appreciated. The wood of buttonwood trees grown in moist situations burns very ill when green, but when it grows on dry, sandy or rocky soils, it burns as freely, when green, as oak cut at the same time. It is not, he thinks, equal to the best kinds of fuel, but it is superior to chestnut, and makes excellent charcoal. "It is a very valuable fuel for stoves. Perhaps it may be ranked with the best kinds of soft maple." If the question is, what kind of tree, on land of the same fertility, will furnish fuel which will give the greatest amount of caloric, he says, "I do not hesitate to declare my perfect conviction, that it, (the buttonwood,) will furnish results much more favorable than any tree our country produces, except the locust on dry soils."

There are many remarkable trees of this kind in various parts of the State. In 1839, I measured two in front of the house of Elijah Bascom, Jr., in Hanover. The first was thirteen feet five inches in girth at the ground, and ten feet two and a half inches at four and a half feet, with many large, spreading branches, forming a broad top and an ample shade. The other was twelve feet and two inches in girth at the ground, and ten feet three inches at four and a half feet, with branches larger but less spreading. In Rochester, one by the road-side was eleven feet in circumference at four feet from the ground. One in Roxbury, in a lot of J. Davis, nearly opposite the house of E. Francis, Esq., measured, in 1837, fifteen feet six inches at five and a half feet from the surface. An old hollow tree near the little bridge over the south branch of the Nashua, in Lancaster, bending over the water, was, in 1840, sixteen feet ten inches at the ground, fifteen feet nine inches at three, and fourteen feet nine inches at six feet. A second near it and vigorous, was, at the same heights respectively, sixteen feet eleven inches, thirteen feet six inches, and thirteen feet four inches. A third, an opening at the foot of which showed that it was extensively decayed at the centre, was twenty-three feet two inches at the ground, eighteen feet six inches at three feet, and eighteen

feet two inches at six, just above a small branch. This is a magnificent tree, holding its size for twenty feet, and, though inclining towards the northeast, sustaining a broad, cylindrical and noble head of great height. At West Springfield, I measured, in 1838, one by the road-side, which I found to be sixteen feet six inches at four feet from the ground.

The oriental plane tree holds the same place on the Eastern continent which our buttonwood does on this. It differs from the occidental, as has been already said, in having a more palmate leaf and a less umbrageous head. Yet it was the greatest favorite among the ancients. Cimon sought to gratify the Athenians by planting a public walk with it. It was considered the finest shade tree of Europe.

Pliny expresses his admiration that a tree valuable only for its shade should have been introduced from a distant part of the world. He tells the story of its having been brought across the Ionian Sea to shade the tomb of Diomedes, in the island of the hero, that it came thence into fertile Sicily, and was among the first of foreign trees presented to Italy, and that too, as early as the taking of Rome by the Gauls. From Italy it was carried into Spain, and even into the most remote parts of then barbarous France, where the natives were made to pay for the privilege of sitting under its shade.* No tree was ever so great a favorite with the Romans. They ornamented their villas with it, valuing it above all other trees for the depth of its salutary shade in summer, and the freedom with which it let in the winter's sun. They nourished it with pure wine;† and Hortensius is related to have begged of his rival, Cicero, to exchange turns with him in a cause in which they were engaged,

* Sed quis non jure miretur, arborem umbræ gratia tantum ex alieno petitam orbe? Platanus hæc est, mare Ionium in Diomedis insulam ejusdem tumuli gratia primum invecta, &c.—*Plinii Sec. Nat. Hist.*, XII, 3.

† Martial wrote an epigram to Cæsar's plane at Tartessus, on the Bætis, the jewel of his palace :

Ædibus in mediis totas amplexa Penates
Stat platanus :

To its other honors he adds—

Crevit et effuso latior umbra mero.—*Epig.*, IX, 62.

that he might himself do this office for a tree he had planted in his Tusculanum.*

Pliny describes some of the most remarkable planes. In the walks of the Academy at Athens, were trees whose trunk was thirty-three cubits, (about forty-eight feet,) to the branches.† In his own time, there was one in Lycia, near a cool fountain by the road-side, with a cavity of eighty-one feet circuit within its trunk, a forest-like head, and arms like trees overshadowing broad fields. Within this apartment, made by moss-covered stones to resemble a grotto, Licinius Mucianus thought it a fact worthy of history, that he dined with nineteen companions, and slept there too, not regretting splendid marbles, pictures and golden fretted roofs, and missing only the sound of rain drops pattering on the leaves.

In more modern times, the Persians have shown an equal partiality to the plane tree, which they call the chinar. Avenues and rows of this tree intersect their gardens; beneath them they love to enjoy the cool breeze, and here they worship; and they or travellers among them ascribe the virtue of protection from the plague to great numbers of these noble trees planted near their dwellings at Ispahan.‡

In the Levant, in Persia, and in other parts of Asia, where timber trees are few, and where the oriental plane is the commonest of trees, it is much used in carpentry, joinery, cabinet-making, and even in ship-building. Olivier says,§ “The plane tree grows naturally throughout all the East; it is common on the banks of the rivulets in Greece, in the islands of the Archipelago, on the coast of Asia Minor, in Syria, and in Persia.” “Its wood is not inferior for cabinet-work to any wood of Europe; it takes a beautiful polish, and is very agreeably veined;” and “the Persians employ no other for their furniture, their doors and their windows.” That it has a beautiful surface and a very smooth grain, and that it takes a bril-

* Macrobius Saturn : II, 9.

† So I understand,—“cubitorum xxxiii, a radice ramos antecedente.”—*Nat. Hist.*, XII, 5. The annotator thinks otherwise.

‡ Evelyn.

§ Olivier's Travels, I, 116.

liant polish, is seen in the famous Scotch snuff-boxes, which are made of it.

Mr. Nuttall has described* a remarkably distinct species of plane tree, which he calls the California buttonwood, *Platanus racemòsus*. The leaves are "divided more than half way down into five, sharp-pointed, lanceolate portions, of which the two lower are the smallest; all the divisions are quite entire, two of them in small leaves are suppressed, thus producing a leaf of only three parts. Above, as usual, the surface is at first clad with a yellowish, copious down, formed of ramified hairs, which quickly falls off and spreads itself in the atmosphere. The under surface of the leaves is, however, always copiously clad with a coat of whitish wool, which remains. The young leaves, clad in their brown, pilose clothing, have a very uncommon appearance, and feel exactly like a piece of stout, thick, woollen cloth. The branchlets, petioles and peduncles are equally villous. The male catkins are small, less in size than peas, full of long haired scales, and with unusually small anthers. The female catkins are in racemes of three to five in number, with remarkably long styles, being between two and three tenths of an inch in length, and persistent on the ripe balls. The raceme with the full grown balls measures nine inches. The tree has, therefore, a very unusual appearance, filled with these very long, pendulous racemes, each bearing from three to four, or even five balls, at the distance of about an inch from each other. The stigmas are at first of a deep and bright brown." Mr. Nuttall supposes the wood to be superior to that of the common species, harder, more durable, and less liable to warp.

The leaves and fruit of this tree are figured in Nuttall's Supplement to the North American Sylva, I, Plate 15, and in Audubon's Birds of America, Plate 362.

The plane tree may be propagated by seed, by layers or by cuttings. The best and surest way is by seed. These are ripe, in our climate, in October or November. They may be readily separated from the globular aments, by beating or by

* Nuttall's Supplement to the N. A. Sylva, I, 47—48.

the hand. By rubbing they are then made clear of the wool. Mr. Cobbett, who raised many plants from seed, soaked it in lukewarm water for forty-eight hours. He then mixed it with finely sifted earth, ten gallons of earth to one of seed; put the mixture upon the smooth, bare ground; "turned and remixed the heap every day for four or five days, keeping it covered with a mat whenever the turning and mixing were not going on; and as soon as a root began to appear here and there, sowed the seeds upon a bed of sifted earth, mixed with the sifted mould, just as they came out of the heap." No other covering was given; they were carefully watered and kept shaded, and in about a week germinated and showed their seed-leaves. This was in April. The plants were gradually inured to the sunshine, and in October their wood was ripe. In the succeeding summer they were fit to transplant into nursery lines.*

General H. A. S. Dearborn, so well known for the skill and success with which he has cultivated forest trees, gives, in the *New England Farmer*, Vol. V, p. 193, valuable directions for raising buttonwoods. He says the balls should not be gathered before the fall of the leaves, or, still better, not till March. He sowed the seeds in the spring, broad-cast, very thick, in a rich seed-bed of fine, light, carefully prepared mould. They were raked in and covered, and the ground was left smooth and level. When the plants first appear, they are very tender, and must therefore be screened from the heat of the sun for several months, by mats or by brush-wood thrown over poles resting on crotched stakes, two or three feet from the ground. He has usually transplanted them, when a year old, into a nursery, placing them a foot apart, in rows three feet asunder. "The seed-bed should be kept clear of weeds, and the ground in the nursery between the rows, dug over every spring, and often hoed and raked." When three or four years old, the plants may be removed, and set wherever they are wanted for shade, ornament, or fuel.

* Woodlands, as quoted by Loudon.

FAMILY VIII. THE WILLOW FAMILY. *SALICINEÆ*.

ENDLICHER.

The willows and poplars form an eminently natural family, of striking properties and extensive and important uses. They are lofty or spreading trees, or low, slender shrubs, occupying the cooler parts of both hemispheres. One of the willows, *Salix arctica*, is found farther north than any other woody plant; and they extend southward into Africa, a single species being found in Senegal. This family has always been one of the most important to mankind. Several species are valuable for their wood, and as affording materials for many of the arts; and the bark of all has important astringent and tonic properties. The bark of the common poplar, the round-leafed aspen, has been used in this country as a febrifuge; and from that of several species of willow, *Salix Russelliana*, *Helix*, and others, most of which are naturalized in this country, a substance called *salicine* has been extracted, possessing the best virtues of the extract from Peruvian bark. The buds of the balsam poplar, or Balm of Gilead, have reputation as a vulnerary. They yield a resinous substance which is collected in shells, and imported for medicinal purposes, into Europe, from Canada. A similar substance, resembling storax, and said to possess diuretic and antiscorbutic properties, is yielded in less quantity by the fragrant buds of the white and tremulous poplars of Europe. The bark of the willow contains, according to Sir Humphrey Davy, as much of the tanning principle as that of the oak; and the leaves of one species are used in Iceland for tanning leather; and the bark of another, in Sweden, Switzerland, and Scotland, for tanning, and for dyeing black. The twigs, the young trees, the wood, and the outer and the inner bark, have been used, in all periods, for the greatest variety of purposes; for cords, ropes, baskets and hurdles, as material for cloth, for the food of domestic animals, and even of man. For in Kamtschatka, the inner bark is sometimes made into bread; and the leaves of the goat's willow, *Salix caprea*, are considered in France, at the present

day, as they were anciently in Italy, the best food for cows, goats and horses.

Both willows and poplars are remarkable for the size and length of their roots, for their fondness for water, and for their tenacity of life. All the species of both genera are easily propagated by cuttings ; and most of them, planted by river sides, serve, like the alders, to protect the banks from being worn away by the action of the stream ; and, from the rapidity of growth, and the hardiness of many of the species, they are admirably adapted to act as nurses to more tender trees in exposed situations.

The family is distinguished by the following characters :—The sterile and fertile flowers are on distinct plants. Both are disposed in many-flowered aments, each flower being supported by a bracteal scale. The ovaries are solitary and one-celled, with many ovules. The stigmas are two. The fruit is a one-celled, many-seeded capsule, opening with two valves. The seeds are very minute, erect, attached to the inner surface of the valves, and circled by a tuft of very long, cottony down. The leaves are alternate.

The genera are two, the Poplar, and the Willow. They are distinguished by the general appearance of their leaves, which, in the poplar, are roundish or triangular in outline ; in the willow, usually long and narrow ; and by the number of stamens, which are from two to seven in the willow, and from eight to thirty or more in the poplar, and set in a little cup protected by a jagged scale.

VIII. 1. THE POPLAR. *POPULUS*. L.

The poplars are large trees, with alternate leaves, and, while young, a smooth, leather-like bark. The buds are more or less invested with a fragrant, viscid balsam. The leaves are large, roundish or triangular in outline, and set upon a long footstalk, which is laterally compressed towards the leaf, whence the leaves have their characteristic, tremulous motion when agitated by the wind. The footstalks are often set with glands. The flowers come out before the leaves, from scaly buds. They are disposed in cylindrical aments, and composed each of a scale deeply cut or torn at the edge. Beneath each scale in the

sterile ament is an oblique, cup-shaped scale, containing from eight to thirty or more short stamens. The similar scale in the fertile flower contains a single ovary, crowned with two bifid stigmas. The matured ovary becomes a capsule, which opens with two valves, disclosing the numerous minute seeds cinctured with a silken or cottony crown. The sterile aments, making their appearance before the leaves, and when few flowers are to be seen, are striking objects from their size, and the rich red color of their very numerous stamens.

The trees of this genus are all of very rapid growth, especially in moist situations, by the sides of running streams; and they are remarkable for the readiness with which they may be propagated by cuttings or layers. They also grow readily amidst the dust and smoke of close and crowded towns. They may thus be planted by persons totally unacquainted with arboriculture, and, in situations where no other tree will flourish, will, in a surprisingly short time, exhibit a pleasant object, and exclude disagreeable ones. Evelyn calls the poplars "hospitable trees, for any thing thrives under their shade."

The wood was used by the ancients for the purpose of making bucklers, as it is very light and somewhat tough, and thence it is not broken, pierced or splintered by a blow, but only indented. "The wood of the poplar is soft, light, and generally white or of a pale yellow. It is of but little use in the arts, except in some departments of cabinet and toy-making, and for boarded floors; for which last purpose it is well adapted, from its whiteness, and the facility with which it is scoured; and also from the difficulty with which it catches fire, and the slowness with which it burns. In these respects, it is the very reverse of pine. Poplar, like other soft woods, is generally considered not durable; but this is only the case when it is exposed to the external atmosphere, or to water; and hence the old distich, said to be inscribed on a poplar plank,—

'Though heart of oak be e'er so stout,
Keep me dry, and I'll see him out,'

may be considered as strictly correct."*

* Loudon, Vol. III, p. 1637.

Insects on the Poplars.—The large, pea-green, stinging caterpillars of the moth called *Saturnia Io*, feed on the leaves of the balsam poplars, as well as on those of the elm, the cornel and the sassafras. (Harris, p. 283.) The caterpillar of the *Cerura borealis*, remarkable for his odd appearance and horned tail, and thence called the horn-tailed caterpillar, also feeds on the several species of poplar. The caterpillars of the *Antiopa* butterfly are found in great numbers on the poplars, the willows and the elm, and commit great ravages on their leaves, (ib. p. 219—and 305.) So do the spinning caterpillars of the *Clostera Americana*, (ib. p. 313), and the caterpillars of the herald-moth. Still more serious injury is done by the boring grubs of the beetle called *Saperda calcarata*, and those of the *Prionus latipennis*. The former live in the trunks, the latter in the trunks and roots of the various kinds of poplar, native and foreign. (Ib. pp. 80 and 88.)

Four species of poplar are native to Massachusetts, the Large Poplar, the American Aspen, the Balm of Gilead, and the River or Smooth-leaved Poplar. Two other species have been extensively introduced, the Lombardy Poplar, and the White Poplar.

Sp. 1. THE LARGE POPLAR. *Pópulus grandidentáta*. Michaux.

The leaf and fertile ament figured in Michaux, Sylva, II, Plate 99, fig. 2.

This is a tall, erect tree, covered with a smooth bark of a soft, light, greenish gray color. The branches are small, and, although they go out at a large angle, rarely form a broad head. The bark on the young branches is dark, but soon takes the uniform, leather-like appearance of the trunk. It is remarkably smooth, but in very old trunks cracks a little.

The leaves, which are often in tufts at the ends of the branchlets, are roundish, with from five to nine, large, blunt teeth on each side, smooth on both surfaces, and paler beneath. The foot-stalk is slender, compressed laterally, two thirds as long as the leaf. The buds are conical.

This tree is found abundantly growing in the forests in the western and northern parts of the State, in which situation it rises to the height of seventy or eighty feet, with a diameter of from sixteen to twenty-four inches, and forms a small, roundish

head at the general level of the tops of the trees. When growing on the edge of a wood or lake, or by itself, it is commonly forty or fifty feet high, with an open and rather graceful head, forming a beautiful object from the soft green of the trunk, the lightness of the branches, and the mobility of the foliage. The wood is soft and light and of no great value.

When, in the time of our grandmothers, fashion required that a lady should seem somewhat taller than nature made her, the light wood of this poplar was in demand, as best adapted for the substance of the high heel of their shoes, and the manufacture constituted a distinct trade. The more substantial heel of the shoes of the lower people was made of more durable and heavier maple. The wood was also extensively used in the manufacture of hats, before the palm-leaf was introduced.

When dry, it is considered equal to pine as fuel. This poplar is found from New Brunswick and the borders of Lake Huron, through the New England and Middle States, to the mountains of Georgia.

Sp. 2. THE AMERICAN ASPEN. *P. tremuliformis*.*
Michaux.

A leaf and sterile ament are figured by Michaux, Sylva, II, Plate 99, fig. 1.

This is a small, graceful tree, from twenty to forty feet high, with a gradually tapering trunk, and small branches moderately spreading. The trunk is covered with a white clay-colored bark, with long blotches of very dark brown, particularly below each branch, in a triangular space, from the upper angle of which the branch issues.

The recent shoots are of a dark, polished bronze green, which is gradually changed, by the influence of light, on the larger branches, to the clay color for which the trunk is remarkable. The branches are, therefore, darker colored beneath. The leafy branchlets are short, and go off at a large angle.

* The word *tremuloides*, as Mr. E. Tuckerman has remarked, is a barbarous compound of Latin and Greek, and ought not to be retained. *Tremuliformis* is the word which Michaux should have used, as he meant to express the resemblance which our aspen has to the *P. tremula*.

The leaves are round in their outline, about two inches long and of equal breadth, somewhat heart-shaped at base, abruptly acuminate, with a wavy, toothed border, covered with soft silk when young, which remains only as a fringe on the edge at maturity; supported by a very slender footstalk about as long as the leaf, and compressed laterally from near the base. They are thus agitated by the slightest breath of wind, with that quivering, restless motion, characteristic of all the poplars, but in none so striking as this. In this respect, it bears a near resemblance to the European tree, after which it is named, and which has given occasion to so many poetical and satirical allusions; whose leaves Gerard compares to women's tongues, "which seldom cease wagging;" and Homer, to give us an idea of the activity of Penelope's maidens at the loom, says,—

"Their busy fingers move
Like poplar leaves when zephyr fans the grove;"

and, best of all, Walter Scott, in his lines,—

"Oh, woman! in our hours of ease
Uncertain, coy, and hard to please,
And variable as the shade
By the light quivering aspen made,
When pain or sickness rents the brow,
A ministering angel thou."

The foliage appears lighter than that of most other trees, from continually displaying the under surface of the leaves. The stipules are small, lanceolate, silky, transient. On the sprouts which spring from the roots of this poplar, the leaves are often many times larger than those of the tree, and so differently shaped, as to lead one not familiar with them to think he has found a new species. I believe the same thing is true of several other species of poplar.

The wood is soft, white, fine-grained, light, and very perishable when exposed to the weather. It is deficient in strength, and is not much used, but might serve well for floors, as it has a good color, and is not liable to splinter when bruised.

The bark is excessively bitter, with a taste precisely like quinine, to which it has an intimate resemblance in its properties.

This tree is found in Canada, as far north as 64°, and thence

southward, somewhat abundantly, through the New England States, and as far as West Chester County, in Pennsylvania.

Sp. 3. THE BALM OF GILEAD. *P. cándicans*. Aiton.

Leaf figured by Michaux, *Sylva*, II, Plate 98; and by Audubon, *Birds*, I, Plate 79.

A handsome tree, attaining sometimes the height of sixty or seventy feet, and usually, when full grown, fifty or sixty, even on the poorest soils. It grows readily and rapidly every where, and makes a tolerably sized tree sooner and more surely than almost any other. It has hence been planted and is still found growing, as an ornamental tree, in many situations where it is extremely difficult to make the other forest trees grow. The recent shoots are stout and large, of a deep green, with long gray dots, smooth and uniform above, ridged with strong ridges below the leaves, and striate with light green towards the base. The small trunks and branches are of a dark grayish green, of the shade called French green, with occasional blotches of a darker color; the stalk, on old trees, rough, with long, narrow clefts, and often ridged with large, projecting ridges above the principal roots. In moist situations, yellow and red lichens and green mosses fill the cavities and invest the bark of the trunk.

The leaves are very large, on footstalks less compressed than in most poplars, and often somewhat hairy above, ovate, round, or somewhat heart-shaped at base, acuminate, obtusely and unequally hooked, serrate quite to the footstalk, somewhat three-nerved, dark green, polished and shining on the upper surface, whitish and with the veins reticulate beneath. Buds and stipules very gummy. The branches are not angled.

It throws its roots to a very great distance just beneath, and in some instances far beneath the surface. In one instance, I knew the roots to pass beneath and throw up suckers on the other side of a house forty feet wide.

This tree is desirable near habitations, on account of its agreeable fragrance in spring, but the abundant cotton of the female aments, and the appearance of the aments themselves, not unlike a large caterpillar, on the ground, constitute an objection. A

more serious one is the liability of the branches, or even the trunk, when very tall, to be broken by the wind. Its particular office seems to be to act as a screen and as a nurse to other more valuable trees while young. When this office is performed, it may be felled, but is not easily eradicated, on account of the extreme vitality of the roots, which continue for years to throw up suckers.

In favorable situations, in a moist, rich soil, this tree attains, in a comparatively short time, to a large size. I have not found this tree growing naturally in Massachusetts or elsewhere. It is, however, more frequently planted for shade and ornament than any other tree of the genus.

Sp. 4. THE RIVER POPLAR. *P. lavigata*. Aiton.

Leaves and a section of a branch figured by Michaux, under the name *P. Canadensis*, Sylva, II, Plate 95.

The river poplar is a noble tree, rising often to the height of eighty feet or more, with a fine long open head. The trunk is of a light granite gray color, somewhat rough in old trees, with roundish ridges, separated by longitudinal furrows. The young trees and the large branches of old trees are covered with a smooth leather-like bark. The smaller branches are of a light gray; they are often dependent from the lower limbs. The upper ones go out at a sharp angle, and tend upwards. The recent, vigorous branches and shoots are of a bright green color, like the leaves, with scattered, long, white, lenticellar dots, and strongly angled by three, brown, sharp ridges running down from the base and each side of the leafstalks. Older shoots are of a grayish green, with the ridges longer, more prominent, and of a darker color. The upper branches are conspicuously ridged, with the bark longitudinally cleft, the ridges frequently cracked across. Pith large, five-angled.

The buds are long, and taper to a long sharp point. The leafstalks are nearly as long as the leaves, and gradually and strongly compressed towards the leaf, at the base of which are often situated two or more conspicuous glands. The leaves are very broad ovate or heater-shaped, nearly as wide as long, being from three and a half to four and a half inches wide, and from

four to five and a half long, right-angled, hollowed or heart-shaped at base, widening suddenly to their extreme width, and gradually but roundly tapering to the point, which is entire, and often considerably prolonged, with a slender, sharp termination; margin undulating, and bordered by large prominent rounded serratures, each ending in a large gland turned towards the end of the leaf, and separated by deep rounded bays; smooth and dark green on both surfaces; with white mid-rib and veins which are irregular and much branched, and equally prominent on both surfaces.

Dr. Barratt tells me that when in flower, the tree seems covered with aments of a light red color, becoming paler when expanded, at which time they are from three to five inches long. This tree occurs on the banks of the Connecticut, above and below Springfield, on the Chicopee, at Chicopee Falls, and in various places on the Agawam or Westfield River, in situations liable to be overflowed in spring. On the Connecticut and its tributaries, it is called the river poplar.

There is a striking difference in the appearance of those branches which are vigorous, and those which are not, the former being strongly angled, the latter often not perceptibly so.

Michaux thinks this tree the same that is called cotton wood by Cass, who accompanied Lewis and Clarke to the Pacific, and by Pike in his account of the northern part of New Spain; the cotton wood of Carolina being too tender a plant to bear the intense cold of the regions in which this tree was found growing. The Mandans, 1500 miles from the mouth of the Missouri, feed their horses, during the winter, on its young shoots.

The river poplar deserves to be introduced into cultivation as an ornamental tree. It is much the tallest and most graceful of those which grow naturally in New England. Its foliage is equal to that of the Balm of Gilead in size, and superior to it in depth of color; and the abundance of its aments in spring, and the rich colors of its leafstalks and young branches, when growing in somewhat dry situations, make it a beautiful object. By selecting cuttings from the sterile tree, the evil complained of in the cotton of the Balm of Gilead will be avoided, and the

tree is of equally rapid growth, and taller and more shapely. It has been extensively introduced in England and France, where it is valued for its beauty and for its wood. Loudon says that the fine poplar avenues in the lower part of the garden of Versailles, are of this species. In England, it is called the Canada poplar, in France, cotton wood.

Dr. Barratt, of Middletown, Conn., has very kindly communicated some very interesting and valuable observations, which he has made in reference to this poplar and others of the genus, together with some striking conclusions as to climate, which he has drawn from the times of flowering of several of the trees. I give them nearly in his own words.

The aments of *P. lævigata* are encased, during the winter and early spring, in buds with resinous scales. When the aments begin to protrude, these scales expand, nearly in opposite directions, and soon fall. This is about April 9th, and by the 18th, they are in full flower. The aments are first of a rose color, and in great abundance, especially on the upper part of the tree. This monarch of the Amentaceæ then presents a noble and cheering sight; and is in a high degree ornamental. As soon as the pollen is shed, which is in two days from the time of the full expansion of the flowers, the rich red pollen cells become pale and shriveled, and the sterile aments are soon scattered in the wind. These aments are from four to five inches long, and have from seventy to one hundred stamens resting on each turbinate scale, and of these scales or clusters of stamens, each ament has sixty or eighty. The carpels, or mature ovaries of the fertile aments, are smooth and ovate, and become ripe about the 18th of June, *just two months from the expansion of the flowers*. This fact is the more remarkable, as it is *just twice the period of the willows*. When the carpels of the poplar are fully open, the cotton adhering to the seeds is shed, and gives the appearance of finely carded cotton, profusely spread among the foliage. Hence the name *cotton tree*, and we have thus this southern material produced in Massachusetts by a forest tree.

The other poplars take nearly the same length of time to bring their fruit to perfection. In 1839, which was an aver-

age year, the aspen began to flower, at Middletown, April 1st, the large poplar, about the 4th, and three others, on the 9th.

Dr. Barratt has observations on the period of flowering through fifteen degrees of north latitude, which give three months as the difference in the time of beginning, or one month's difference for five degrees of latitude, which is equal to six days for one degree; so that spring goes northward at the rate of one degree in six days, or ten miles a day. This is the average for fifteen degrees, and would give a difference of five days between Middletown and Boston, the difference of latitude being $48^{\circ} 12''$. The actual difference is greater, being from six to ten days, showing that the advance of spring is not uniform throughout every part of the fifteen degrees. The difference against Boston is probably owing to the influence of the chilling north-east winds which prevail at that season of the year.

Dr. Barratt's conclusion is not far different from that reached by Dr. Bigelow,* from a comparison of the times of flowering of several common plants, in various parts of the United States and Canada, in the spring of 1817. Dr. Bigelow made a difference of two months and a half for a difference of latitude of $13^{\circ} 45'$, which would be three months for $16^{\circ} 30'$. Generalizations of this kind, to be valuable, must be cautiously made, drawn from the average of a large number of species, and a somewhat long series of years. In the data furnished by Dr. Bigelow's correspondents, if an inference were drawn from the apple and pear alone, the difference in the season between Charleston and Montreal, whose difference of latitude is $12^{\circ} 51'$, would be only one month and twenty-one days; if from the flowering of the blood root, it would be only one month and eleven days, conclusions widely different from those drawn from the average of all the species observed.

Sp. 5. THE NECKLACE POPLAR. *P. monilifera*. Aiton.

Leaves figured in Michaux, Plate 96. A leafy branch is figured by Abbott, Insects, II, Plate 71, with the Kitten Moth.

This tree has an erect or slightly bending trunk, tapering gradually to a height of fifty or sixty feet, and covered with a

* See Memoirs of the American Academy, Vol. IV, p. 77.



dark granite gray, moderately rugged bark. The branches, when the tree grows on high and rather dry land, are small, horizontal or arching upwards, with the bark more broken than on other poplars, and having a speckled appearance. The branchlets are spreading and pendulous, greenish gray, and soon roughened by transverse cracks. They are slightly angular towards the extremity. The recent shoots are very tough, greenish, or greenish gray, and very slightly angled by ridges running down from the leaves. Buds of a moderate size, shining, but with very little balsam. Leafstalk long, somewhat compressed, with the upper edge sharp or roundish, with conspicuous glands above, at the base of the leaf. Leaves broad ovate, nearly as wide as they are long, rounded or making nearly a right angle with the stalk at base, tapering rapidly to a short point, with large rounded serratures ending in a callous or glandular point, looking towards the end of the leaf; green and smooth on both surfaces, somewhat paler beneath. Pith in the small twigs very large and five-angled.

The wood is white, soft, close-grained, resilient, not disposed to splinter, and resembling apparently, in its other properties, that of the other poplars.

This is usually a slender, rather handsome tree, with a spiry, but somewhat open head.

It is found, cultivated, on the Connecticut River. In 1837, I found a large tree, growing naturally by the side of a stream in New Ashford, the leaves of which agree perfectly with those which I gathered in Middletown, from trees which Dr. Barratt pronounces to be the necklace poplar.

The resemblance between the leaves, branches and trunk of this tree, and those of the river poplar is such, that I should take them to be varieties of the same species. Dr. Barratt considers them as sufficiently distinguished by their fructification. In other respects I can see no marked difference, except in the smallness, and in the paleness of the under surface, of the leaves of the necklace poplar.

The tree in New Ashford, of which I have spoken, was supposed by the inhabitants to be a Balm of Gilead. It grows by the side of a small river, in a rich intervale, and measured, in

1838, twenty feet and five inches in circumference, at the smallest part between the ground and the branches. When first observed, fifty-five or sixty years previous, it was a small tree, not two inches in diameter. To whichever of the two species it belongs, it is a most favorable specimen of rapid growth; and it is a fine, broad headed tree.

The necklace poplar is so called from the resemblance of the long ament of matured fruits, before opening, to the beads of a necklace. It has been cultivated for many years in Europe, where it is called Virginian poplar, and Swiss poplar, the last name being given from its having been extensively propagated in Switzerland. It is also known in England by the name of Black Italian poplar, from having been introduced from Italy. It is valued for the great rapidity of its growth, which is, in the climate of London, between thirty and forty feet in seven years; and even in Scotland, it has grown to the height of seventy feet in 16 years; thus becoming of a size for timber, sooner than any other tree. Its timber is considered valuable in building, as, like that of the other poplars, when kept dry, it is very durable. Male trees are much to be preferred, in the vicinity of dwelling-houses, as the cotton of the seeds adheres to clothes and furniture in a most troublesome manner.—(*Lou-don's Arboretum*, III, 1658, 1659.) Cuttings of this tree root more freely than those of the previous species.

There is another poplar, the true Balsam Poplar, found in Canada, in Maine, in Vermont, and in Connecticut, north and south of us, and therefore probably also in Massachusetts, which I have not detected growing naturally in any part of the State. It has a great resemblance to the Balm of Gilead, differing from it in having smaller leaves, which are uniformly rounded at base and never heart-shaped. In the upper part of the town of Kennebunk Port, in York County, Maine, in a sheltered hollow of three or four acres, by the side of the Kennebunk River, on the land of George Thompson, I found this tree growing naturally in large numbers. Thence it has been extensively propagated to the neighboring towns. On the leaves of the trees there, I observed the caterpillar of the kitten moth, *Phalæna fur-*

cula, which Abbott has represented as living on the leaves of a kindred species, the necklace poplar, in Georgia.

VIII. 2. THE WILLOW. *SALIX*. L.

The willows are distinguished from the poplars by having the scales which form the aments entire, and by having only from one to seven stamens in the sterile flowers. The fertile contain a single ovary surmounted by two stigmas which are usually two-parted. The willows are shrubs or trees, varying in height from two or three inches, to eighty or ninety feet. They are natives of the cooler regions of the northern hemisphere, some of them being smaller, and extending farther north, than any other woody plants, and others being found in mountainous regions in Africa, India, China and Peru. Growing naturally on plains in moist situations by water courses, they are often lofty trees; on mountains and dry plains, they are for the most part diminutive shrubs.

The roots of the willows are remarkable for their toughness, magnitude, length, and tenacity of life. On the borders of streams, they often form masses which present a powerful resistance to the action of water; and they are not unfrequently many times larger and longer than the stems which issue from them. The stems are upright or spreading; the branches round, slender, and very flexible; the bark rather tough; the leaves simple, and usually of much greater length than breadth; and accompanied, on opening, by two stipules, which are often permanent and remarkably large, but often caducous; the buds are covered with a leathery, concave scale. The aments are terminal or lateral, and appear, in different species, before, with, or after the leaves. The willows are like the poplars in the rapidity of their growth, and in the facility with which they may be propagated by offsets, layers and cuttings.

“The many important uses,” says Hooker, “rendered to man by the different species of willow and osier, serve to rank them among the first in our list of economical plants.” In the extreme north-western regions of Europe, the inner bark is kiln-dried and ground, to be mixed with oatmeal in times of scar-

city, and in the same countries at present, as in many countries at an early period of civilization, the twigs and branches have been of important use in constructing household utensils, panniers, harness, apparatus for fishing, and even habitations. The tough bark may be used for cords and matting, and in Tartary, its fibres have been spun and woven into cloth. Dr. Walker, a writer upon the willows, relates that "he has ridden in the Hebrides with a bridle made of twisted willow twigs, and lain all night at anchor with a cable made of the same material." —*Loudon*, 1450.

The bark of most species of willow, especially when stripped from the younger branches, is remarkable for its bitterness and astringency; and has been long employed, with marked success, in the treatment of intermittent fevers, and in other cases which require the use of tonics. It is the best substitute known for Peruvian bark. In like manner, the salicine already spoken of, in the form of a sulphate, may take the place of sulphate of quinine, and is said to be preferable, in the case of patients of a delicate and irritable temperament.*

The wood of the willow is soft, smooth, light, elastic, pliant and tough. In Europe, in ancient and modern times, it has been applied to many uses for which, in this country, other woods are commonly preferred. The larger trees take the place of pine, and are sawn into boards and planks for the framework and flooring of buildings; and, when kept dry, are found to last without decay, for more than a century. In Scotland, small vessels are made of the wood. It is also in request for the use of the turner, and for lasts and toys, as a substitute, when dyed, for ebony, also for ladders, for implements of husbandry, for the lining of carts, and especially for use in works exposed constantly to water. The branches and twigs are of the first value for all kinds of wicker work and basket making, for hoops, and for all the purposes for which toughness, pliancy and elasticity are required. The wood is also extensively used, in many parts of Europe, for fuel, making a pleasant, clear fire, with

* *Elémens d'Histoire Naturelle Médicale*, Par M. Achille Richard. 3me ed., 1838. Tom. III., 185.

little smoke. The best sorts for timber are the white, the Bedford, the crack-willow, and the goats' willow, the three first of which have been introduced into this country, and are often seen growing here.

The leaves of the willows are devoured by the large black caterpillars of the Antiopa butterfly, (*Vanessa Antiopa*, Harris's Report, p. 219), and the branches are sometimes completely stripped. The caterpillar of the fork-tail moth, (*Cerura borealis*, ib. 305), is also found on their leaves. A species of plant-lice called by Dr. Harris, the plant-louse of willow groves, (*Aphis Salicis*, ib., p. 191), is found clustered together in great numbers on the under side of the branches of various kinds of willow, and drawing their subsistence from the plant on which they live. The grubs of the horn-bug, (*Lucanus Capreolus* ib. p. 40), live in the trunks and roots of old willows, as well as in those of apple trees and oaks.

The male and female trees of the various species of willow, are found to differ in their luxuriance and growth, and somewhat in the quality of the wood. The female is thought to grow with more vigor, and to produce larger stems, the male to have equal toughness, but to be more slender and delicate. The usual properties of our native willows will be mentioned, when known, in the description of the several species.

The willows present greater and more numerous difficulties to the student than any other family of plants. These have been enumerated by one of the greatest of modern botanists, (De Candolle, *Flore Française*, III, 282,) as follows: 1. The species are often trees which can be but imperfectly judged of from figures or specimens; 2. The male and female are distinct plants, so that the knowledge of an individual does not complete that of the species; 3. The flowers often expand at a different time from the leaves; 4. The leaves present little variety and few marks of distinction; 5. The seeds are usually unproductive, so that we are prevented from rearing doubtful species for study; 6. Most of them grow readily from cuttings, a frequent and most fertile cause of varieties; 7, and lastly, garden cultivation entirely changes their appearance.

For these reasons and others, there is little certainty in regard

to several of the species; and in regard to many of the native sorts, I have not had opportunities of making sufficiently accurate and continued observations to authorize me to speak with confidence. I have received important assistance from Dr. J. Barratt, of Middletown, Conn., who has long studied this genus with great care; and I shall follow his arrangement of the species, and rely on his authority in describing some as distinct, which I should be disposed, from my own imperfect observations, to consider as only varieties. I am not sufficiently well acquainted with them to present a strictly popular view, and am therefore obliged to offer that which follows.

GROUP FIRST. THE SALLOW. *Cinereæ*. BORER.

These are upland, grayish shrubs, more or less downy, especially at an early period of their year's growth, and with leaves very light colored beneath.

"*Their aments are oval or oval-cylindrical, expanding before the leaves; stamens two, beginning to expand at the apex of the ament; scales red, afterwards turning black. Younger female aments recurved. Ovaries stalked. Younger stigmas mostly red or pale yellow, finally turning green. Leaves obovate, lanceolate, mostly very entire, hoary, with white or ashy hairs, rugose; with the margins often revolute.*"—Barratt, *Salices Americanæ*.

Sp. 1. THE SAGE WILLOW. *Salix tristis*. Aiton.

Leaves long, linear-lanceolate, or oblanceolate, acutely wedge-shaped at base, acute, or sometimes rather obtuse, at the end, entire or distantly waved-toothed, often revolute at the edge, the upper surface somewhat downy at first, afterwards smoothish; the under surface glaucous or whitish, sometimes downy, sometimes rugose with prominent smooth veins; stipules minute, narrow, lanceolate, caducous; aments very small, coming out before the leaves; scales oblong-roundish, hairy at the margin, turning black; ovaries stalked, covered with a grayish, silky down; style short.

The two varieties which have usually been considered as the species, *tristis*, and *Muhlenbergiana*, run into each other, and are properly considered by Dr. Barratt as forms of a single species. They are found on dry, sandy plains, the smaller variety con-

spicuously grayish and sage-like in its appearance, and from one to three feet high; the larger, three or four feet high, with larger, broader, and longer leaves of a deeper green.

The sage willow is a slender, hoary plant, or a spreading tufted bush, one or two feet high, growing in the openings and on the borders of dry, sandy woods. Its root is large and strong, often an inch or two in diameter, with reddish wood and thick bark, extending some distance, often two or three feet, at a few inches beneath the surface. From this rise several stems of a yellowish green, or, later, grayish brown, somewhat downy, and clouded often with dark brown. The central stem, long and very slender, bears the fructification. After the decay of which, it is bare, or with a few leaves at the extremity. From the lower part of it, and from the other stems, shoot the leaf-bearing branches. On these the leaves are somewhat crowded, narrow-obovate, spatulate, one or two inches long, broadest towards the upper end, and tapering gradually to a very short petiole, acute at the extremity, reflexed and waved at the margin, downy on the mid-rib and veins, and corrugate, sage-like above, whitish tomentose beneath. It not unfrequently bears small leafy cones.

In one sub-variety, the leaves are crowded and very short, not half an inch long, and the whole upper part of the plant is covered with a dense, whitish gray tomentum.

Var. 2.—Very much like this, but larger in all respects, is the variety which has been called Muhlenberg's willow.

The main stem is smooth and of a bright green below, clouded and somewhat downy above. The recent branches greenish yellow, downy, and spreading. Leaves from one and a half to three inches long, oblong lanceolate, half an inch wide, pointed at the extremity, rounded or rather acute at base, entire, waved, revolute at the margin, corrugate with depressed veins, and sage-like, with the mid-rib downy above, glaucous, with the mid-rib and veins prominent beneath, but without down on the mature leaves. The young leaves are downy on both surfaces,—revolute in æstivation; stipules small, ear-shaped, pointed above, with one or two teeth on each side, recurved at the margin, sometimes appendaged at base.

Var. 3.—Similar to these and resembling them in the naked, persistent, virgate stems which had borne the fructification in the preceding spring, is a willow intermediate between these and *S. rostrata*, perhaps a variety of the latter, with broad, oblong, lanceolate leaves, waved or crenate at the margin, and revolute, smooth but corrugated and sage-like above, very downy beneath, pointed, often acuminate, at the end, rounded at base, on a short petiole. I take this to be *S. recurvata* of Pursh.

It is a shrub six or eight feet high, with light brown bark on the trunk, dark brown above, with a dark, clouded pubescence on the last year's shoots. The recent shoots are pale green, and somewhat pubescent.

Leaves on short petioles, lanceolate or oblanceolate, usually broader towards the extremities, rather acute at each end, nearly entire, with a light, silky pubescence above when young, afterwards smooth and shining, but strongly marked with depressions at the veins and nerves; rugose and veiny beneath; revolute and waved on the margin; veneration revolute. Stipules about as long as the petiole, unequally ovate, pointed, sometimes entire, often with one or two teeth on each side, downy.

Aments appearing before the leaves and on distinct branches, the staminate half an inch long, often recurved, with two or three small leaves at base; scales rounded, brown, with thin, long, silken hairs, particularly on the edges; stamens two, on long filaments. Pistillate, one third to one half an inch, recurved; scales dark brown, somewhat silky; germens ovate, closely covered with whitish, silky pubescence, supported on long pedicels, and tapering gradually to the bifid stigma.

Sp. 2. MUHLENBERG'S WILLOW. *S. Muhlenbergiana*. Barratt.
S. conferta. Muhl. Willd.

Leaves oblong-lanceolate, remotely serrate, acute, smooth above, plain and downy beneath; recent shoots smooth; stipules lunate, somewhat dentate; aments preceding the leaves, diandrous; scales lanceolate, obtuse, villous; ovaries stalked, lanceolate, silky; style bifid, stigmas bilobed.—*Pursh*, II, 612.

Branches blackish, the younger ones pubescent. Leaves oblong-lanceolate, acute, remotely, minutely and acutely serrate, very entire at base, above deep green, smooth, beneath plane, not rugose-veined, softly tomentose, late in autumn nearly smooth. Leaf-stalks long. Stipules middle-sized, lunate, some-

times very entire, oftener furnished with one or two conspicuous teeth near the base. Aments preceding the leaves; the male scarce an inch long; female an inch, cylindrical-oblong, obtuse. Scales lanceolate, very villous. Ovaries lanceolate, villous. Style elongate. Stigmas four, cylindrical.—*Willdenow*, Sp. pl., IV, 705.

This willow occurs very abundantly within, and on the borders of both dry and moist woods, in most parts of the State. It is a shrub from two or three to nine or ten feet high. Flowers about the 15—20 of April, ripens its capsules in May.

GROUP SECOND. THE TWO COLORED WILLOWS. *Discolores*. BORER.

Aments oval or cylindrical, preceding the leaves, smooth, silky or woolly, destitute of floral leaves at the base. Scales turning black; stamens two, free or united, expanding first at the end of the ament. Ovaries stalked, somewhat pubescent. Leaves somewhat coriaceous, deciduous, serrate or denticulate, smooth and shining above, glaucous and pubescent beneath. Trees or shrubs.—Barratt.

Sp. 3. THE TWO COLORED WILLOW. BOG WILLOW. *S. discolor*. Muhlenberg.

Leaf figured in Annals of Botany, II, Plate 5, fig. 1.

Leaves oblong, rather obtuse, smooth, remotely serrate, very entire at the apex, glaucous beneath; stipules lanceolate, serrate, deciduous; aments opening nearly with the leaves, diandrous, oblong, downy, scales oblong, acute, black, hairy; ovaries sessile, lanceolate, downy; style rather short; stigmas two-parted.—*Willd.*, IV, 665. *Pursh*, II, 613.

“Stem shrubby, rarely arborescent; branches dark-colored. Leaves oblong, an inch or an inch and a half in length, rather acute, somewhat narrower at base, remotely serrate, very entire at the apex, smooth on both surfaces, glaucous beneath. Younger footstalks downy, adult, smooth. Stipules small, lanceolate, serrate, deciduous. Male aments scarce an inch in length, oblong. Filaments white. Anthers red, turning yellow. Female aments an inch long. Scales oblong, acute, villous. Ovaries oblong-lanceolate, hairy. Style middling. Stigma four-cleft.”—*Willd.*, IV, 665.

I have many specimens of leaves and flowers, which Dr. Barratt pronounces to belong to this willow. They do not, however, agree with the description of *Pursh* or the better description of *Willdenow*. The leaves are not “rather obtuse,”

nor the "ovaries sessile;" and the leaves are twice or thrice as long as those described by Willdenow and figured in the Annals of Botany. Dr. Barratt has paid far more attention to this family, and with far better opportunities for studying it than either of the above-named botanists; and he will, doubtless, remove these difficulties in his long-hoped-for work on American willows.

There are great defects in the descriptions given of our willows, by most foreign botanists. Not unfrequently, their descriptions will apply equally well to several plants, and specimens may be gathered from the same plant, more unlike than the descriptions of so called distinct species. Dr. Bigelow found this willow in wet swamps at Dedham.

Sp. 4. THE WOOLLY-HEADED SWAMP WILLOW. *S. eriocéphala*.
Michaux.

Leaves elliptic-lanceolate or oblong-lanceolate, entire and wedge-shaped at base, entire, remotely, and indistinctly, or distinctly serrate on the edge, mucronate, the serratures more multiplied and sharp towards and sometimes quite to the point; green above, glaucous, or ferruginous beneath; when young, conspicuously downy on the whole of both surfaces; late in the season downy on the mid-rib above, and on the whole surface beneath, rarely smooth. Stipules half-heart-shaped, serratures pointed, rarely somewhat obtuse.

Branchlets dark brown or purplish, very downy.

A small tree, conspicuous in the swamps in April for its large and very densely woolly catkins.

The short description of Michaux, Fl. Bor. Amer. II, 225, "Diandrous, branchlets minutely tomentose, leaves oblong-oval, somewhat retuse at base, serrulate; aments oval, exceedingly villous," applies equally well to nearly all the willows of this section.

Sp. 5. THE PRINOS-LIKE WILLOW. *S. prinoides*. Pursh.

Leaves oval-oblong, acute, remotely undulate-serrate, smooth, glaucous beneath; stipules semi-cordate, cut-toothed; aments preceding the leaves, hairy; ovaries stalked, ovate, acuminate, silky; style long; stigmas bifid.—*Pursh*, II, 613.

The matured and flowering branches are smooth, shining, dark purple. The recent, leafy twigs, very slightly downy,

and brownish at first, but soon turning dark and smooth. The leaves are oval-oblong or elliptic-lanceolate, entire and wedge-shaped, remotely waved-serrate, sometimes distinctly serrate, on the edge, ending in an acute or prolonged point, mostly entire. Young leaves silky-downy, mature, smooth on both surfaces; mid-rib sometimes downy above; glaucous beneath; of a thin and delicate texture. Stipules half-heart-shaped, or ear-shaped, sometimes small and nearly entire, sometimes half an inch long and more or less sharply toothed.

Female ament cylindrical, one or two inches long, somewhat crowded, on a short stalk invested with a few cucullate, silky-downy, whitish, transformed leaves; scales oblong, hairy, purple; ovaries on a rather long stalk, ovate, silky, tapering to a long style, with the stigmas somewhat deeply cleft. Male ament an inch or more long; filaments long.

Sp. 6. DENSE-FLOWERED EARLY WILLOW. *S. crassa*. Barratt.

Leaves elliptic-lanceolate, rather distantly serrate; towards the base entire,—three and a half inches long, one inch broad, above glabrous, dull green, beneath veined and clothed with short ferruginous hairs; adult leaves subcoriaceous. The under surface in autumn is glaucous and partially divested of its pubescence. Stipules small, lanceolate, serrate, or frequently wanting—male ament ovate, sessile, three quarters to one inch long; after flowering, two inches long, densely clothed with yellowish-white, silky hairs; scales obovate. Capsules pedicellate, ovate-lanceolate.—*Barratt*, Sal. Am. p. 7.

Flowers April 1—10; capsules ripe May 4—6.

“A small tree about fifteen feet high; bark on the stem rough and ash-colored; branches irregular and knotty; twigs thick, and densely flowered. The ends of the young branches protected by a soft pubescence.

“This is a very hardy species, and one of the handsomest early willows we possess, and highly ornamental in plantations. A few sunny days in spring will cause its rich yellowish white catkins to expand or open. It is so admirably adapted to withstand cold by its dense soft hairs, that the frosts of spring retard, but do not injure or kill its expanded catkins. The clothing or wool of the aments, is not sensibly changed in color by the solar ray. This species is rather rare with us, and may possibly be

found more plentifully in higher northern latitudes. It seems, indeed, to possess all the fitting requisites for enduring a severe climate; and affords a beautiful exemplification of nature's economy, in the structure of the catkins of the willow, providing those exposed during flowering time to severe cold, with a vesture which outvies the imperial ermine."—*Barratt*.

Sp. 7. THE FROST OR TENDER WILLOW. *S. sensitiva*. Barratt.

Leaves ovate-lanceolate, acuminate; cuneate and entire at the base, finely serrate at the point, and more distantly and strongly serrated towards the base; leaves three to five inches long, one and a half to two inches wide; glabrous; above deep green, beneath smooth and pale green, and of a thinnish texture. Stipules subfalcate, serrate. Mas. aments rather lax, one and a half inches long; scales lanceolate, black, lightly clothed with grayish black hairs. Aments and flowering branches frequently destroyed by frost.—*Barratt*.

Flowers April 1—10.

"A small tree about fifteen feet high. This species has not hitherto been described. It bears large, smooth leaves with greenish branches. The aments and twigs are frequently destroyed by frost in flowering time. When it has been thus killed, the aments and branches blacken, afterwards some scattering flowers appear, but these are generally of inferior size.

"The twigs of *S. sensitiva*, at their extremities, have but a slight velvety pubescence to protect them; and the aments are sparingly clothed with hairs. It offers a striking contrast to *S. crassa*, with its dense, woolly catkins, which are uninjured by the frosts to which they are exposed during the period of flowering. When the catkins of *S. sensitiva* begin to expand, on the approach of the flowering season, the large scales of the buds, or shields, covering the aments, fall, or when these are purposely removed for observation, the aments present a lively red color. The direct solar ray soon changes the scales of the aments to black, (very similar to the action of nitrate of silver, when exposed to light, but less rapid.) The hairs of the ament are, also, changed to a blackish gray. An attentive observance of this and some other willows, has satisfied me, that the hairs or clothing of the scales of the catkins, besides protecting them from frost, perform in this and other groups, a function similar

to the scales of the ament; and the scales are manifestly only modified leaves. This subject I have treated at length in my manuscript essay on the willows, and can here only briefly advert to these interesting facts."—*Barratt*.

Dr. Barratt has long and attentively studied these two willows, and I insert his descriptions at length. Both of the plants are found abundantly at Brookline and elsewhere, and answer to the descriptions which Dr. Barratt has given. I have, however, always considered these two and the two preceding, as varieties of one willow, with some striking differences, certainly, but not greater than are found in what are universally admitted to be varieties of the apple, the pear, and the plumb trees.

GROUP THIRD. THE GRAYISH WILLOWS. *Grisea*. BORER.

Aments cylindrical, rather short, preceding the leaves, with two or three minute leaves at base; stamens two, opening usually first from the middle of the ament. Ovaries sessile or stalked, grayish silky. Leaves lanceolate, serrate, grayish silky beneath, turning black on drying. Shrubs with branches brittle at base, and an intensely bitter bark.—*Barratt*.

Sp. 8 THE BRITTLE GRAY WILLOW. *S. grisea*. Willdenow.

Leaves lanceolate, acuminate, serrulate, smooth, but downy on the mid-rib above; silken or naked beneath; stipules linear, deflexed, deciduous; aments preceding the leaves; scales oblong, hairy, black at the apex; ovaries oblong or slightly tapering, on a short stalk, silky; stigmas sessile, obtuse.—*Pursh*, II, 616. *Willd.*, Sp. pl., IV, 699.

A shrub usually five or six feet high, sometimes a small tree twelve or fifteen feet high, growing in or near places wet or inundated the greater part of the year, usually much branched and abundantly set with leaves. The female aments are very numerous, coming out just before the leaves, half an inch long, erect, on a short footstalk, which is invested with two or three linear leaves, of nearly the same length as the aments. Ovaries gradually tapering or ovoid, on a very short stalk, crowded. Smaller branches reddish green, or greenish, at last olive, tough, but very brittle near the base. Older ones ashy gray. Stem on

old trees covered with whitish and grayish membranaceous lichens. Male aments three fourths of an inch long, with broader leaves on the footstalk, very silky. Leaves half an inch by three inches or more, lanceolate or narrow-elliptic, sometimes a little falcate. Stalk rather long, silky above, rounded or rarely acute at base, tapering to a long point, serrate, the serratures glandular and bent towards the point of the leaf, sometimes undulate, smooth, often shining, with the mid-rib downy above; glaucous, silken, or hairy, sometimes smooth, beneath. Stipules half-heart-shaped, ending in an acute or blunt point above, serrate. The leaves on the branches near the trunk, smaller, more acute, and silky.

This perfectly well characterized willow is found at Mansfield, Ipswich, Ware, Williamstown, and in many other parts of the State. Its twigs are long and slender and very tough, yet extremely brittle for an inch or two at base, so as to break short with little resistance. The leaves blacken in drying, and communicate a deep permanent stain to the paper in which they are dried or afterwards kept. It promises to be useful to the basket-maker, and probably contains, in its extremely bitter bark, a valuable dye, as it certainly does a great quantity of some bitter principle.

GROUP FOURTH. *Viminàles*. BORRER.

The basket osier, *S. viminàlis*. L. has been introduced and is doubtless found in Massachusetts. I have not found it growing.

GROUP FIFTH. THE BRITTLE WILLOWS. *Frágiles*. BORRER.

Aments stalked, cylindrical, lax, acuminate, expanding with the leaves or after. Scales greenish yellow, downy, or smooth. Stamens two to five, expanding first from the base of the ament. Ovaries smooth. Leaves lanceolate, or lanceolate-falcate, serrate, denticulate, or entire. Trees.—Barratt.

A less natural group than the preceding. The species would fall easily into three sub-groups; *S. frágilis*, *decipiens*, *Russeliàna* and *vitellina*, forming the first; *S. lùcida*, the second,

(unless this would more properly be thrown among the *Cordata*); and *S. Babylónica*, *nigra*, and *Purshiana*, the third.

Sp. 9. THE CRACK WILLOW. *S. fragilis*. L. *Introduced*.

Figured in Sowerby's English Botany, Plate 1807, and in Loudon, VII, Plate 205.

Leaves ovate-lanceolate, pointed, serrated throughout, very smooth; foot-stalks glandular; stipules half-heart-shaped, pointed, toothed; ovaries on a short stalk, oblong-ovate, smooth; style short; stigmas bifid, longer than the style; scale oblong, about equal to the stigmas and ovaries, pubescent, ciliated; male flowers with an abortive ovary.—*Hooker, British Flora*, 1st ed. p. 417. *Loudon, Arboretum*, 1516.

"A tall, bushy-headed tree, sometimes found from eighty to ninety feet in height, with the branches set on obliquely, somewhat crossing each other, not continued in a straight line outwards from the trunk, by which character it may readily be distinguished in winter."—*Sir J. E. Smith*. The branches are round, and "so brittle at the base, in spring, that with the slightest blow they start from the trunk." Hence is derived its name, and from this fact Sir J. E. Smith infers that the wood cannot have the valuable properties which have been attributed to it, they belonging, of right, to the Bedford willow.

If this is the only ground of his decision, it is a rash one, since most of the willows in this country which are remarkable for toughness, are also remarkable for breaking easily at the base of the branches, in spring, and, indeed, at other seasons. The long branches which form the head of this fine tree should have shown that they must have considerable strength to resist the force of the wind at such a height. And a practical man, Mr. Mathew, gives a very different opinion. "The red-wood willow, or stag's-head osier, (*S. fragilis*), produces timber superior to that of any other tree willow. It is much used in Scotland for building small vessels; and especially for fast-sailing sloops of war, by reason of its lightness, pliancy, elasticity, and toughness. The wood, when dry, is easily known from that of all other willows, by its being of a salmon color; on which account it is sometimes used in cabinet-making and for children's toys."—*Loudon, Arb.*, 1460.

This willow, a native of Britain, has been introduced and somewhat extensively propagated in this vicinity. Some of the largest willows near Boston, particularly those on Willow Street, in Dorchester, are of this species. I find some of the leaves at the base of the aments and on the accompanying branchlets, perfectly entire. This seems, also, to be the case with those figured in Eng. Bot., 1807.

The four large willows above referred to, were measured, in 1839, and gave, at three feet from the ground, the following dimensions in girth:—the 1st, fifteen feet six inches; 2d, fifteen feet seven inches; 3d, fifteen feet eight inches; and the 4th, eighteen feet four inches at four feet, and twenty-one feet six inches at one foot from the ground. The first three were thought to be fifty years old, the fourth sixty or more. This last is a fine tree. It continues to enlarge to the height of nine or ten feet, where it throws out four large branches. Several smaller ones have been broken off by the wind.

Sp. 10. THE VARNISHED WILLOW. *S. decipiens*. Hoffman.
Introduced.

Figured in Sowerby's English Botany, Plate 1937.

Leaves lanceolate, pointed, serrate, very smooth; floral ones partly obovate and re-curved; footstalks somewhat glandular; stipules half-ovate, acute, toothed, small, often wanting; ovaries tapering, stalked, smooth; style longer than the cloven stigmas; branches smooth, highly polished.—*J. E. Smith, Eng. Fl.*, IV, 183. *Hooker's Eng. Bot.*, 417; *Loudon, Arb.*, 1515.

“This forms a small tree of handsome growth, flowering in May. It is readily known by the very smooth bark of the last year's shoots, which is of a light reddish brown, or clay color, appearing as if varnished. The young twigs are often beautifully stained with crimson. Leaves very much akin to those of the Bedford willow, but mostly smaller.”—*Smith, in Eng., Bot.* 1937.

The varnished or porcelain appearance of the branches, not conspicuous at other seasons, makes this willow easy to be distinguished in winter and early spring. It has been extensively propagated in the neighborhood of Boston, and may be seen in

great numbers, in Chelsea, on the turnpike road to Salem, and in West Cambridge, in several places on the road to Lexington.

This species is a native of Britain, and has been much cultivated in England for basket work. For a few years, in moist ground, it annually produces rods six or eight feet long, but these gradually become shorter, and the plant ceases to be worth cultivating.

Sp. 11. THE BEDFORD WILLOW. *S. Russelliana*. Smith.
Introduced.

So named in honor of the Duke of Bedford, who first brought it into notice.

Figured in Sowerby's Eng. Botany, 1807, and Loudon, III, 1518.

Leaves lanceolate, tapering at each end, strongly serrated throughout, smooth, very pale beneath; footstalks glandular, or leafy; stipules half heart-shaped, strongly serrate, pointed; ovary stalked, lanceolate, smooth, longer than the scale; style as long as the bifid stigmas; scales narrow, lanceolate, slightly ciliated.—*Hooker, British Flora*, 418; *Loudon, Arb.*, 1517.

This tree, a native of Britain, attains sometimes to as great a height as the crack willow, and is considered far more valuable. It is remarkable for the rapidity of its growth in its natural soil, and it grows with more vigor, in the neighborhood of Boston, than any other willow, native or foreign. The favorite tree of Dr. Johnson, at Litchfield, which was destroyed a few years ago by a hurricane, was of this species.* It is extensively cultivated in England for poles, for its wood, and for its bark, which has been ascertained to contain more of the tannin principle than the oak. Mr. Lowe, in his survey of Nottinghamshire, says that a plantation of it, of eight years' growth, yielded a net profit of 214*l.* per acre. It flowers in April or May.

This tree may be known from the others of this group by the length and brightness of the leaves, their large serratures, and their occasionally leafy footstalks, and by the length and

* A few years before the Doctor's death, this tree measured fifteen feet nine inches in circumference, at the ground, and eleven feet ten inches at the smallest place below the branches. It continued to increase till 1810, when it measured twenty-one feet in girth, at six feet from the ground. In 1829, it was blown down. Loudon has given a figure of this tree as it appeared at the time of Dr. Johnson's death, and also just before its destruction. See *Arboretum*, III, pp. 1520, 1521.

straightness of its vigorous green shoots. It is found in Roxbury, along the Lowell road, and for some distance along the brook which runs near Mr. J. A. Lowell's house. It is there mingled with the yellow willow.

Sp. 12. THE GLOSSY WILLOW. *S. lucida*. Muhlenberg.

The leaf is figured in the Annals of Botany, II, Plate 5, fig. 7, and in Michaux, Sylva, III, Plate 125.

Leaves ovate oblong; cuspidate, acuminate, rounded and somewhat alternate at base, sharply serrate, with glandular serratures, smooth and shining on both surfaces; stipules oblong or roundish, glandular-serrate; aments appearing with the leaves; about three to five stamens; scales broad-lanceolate, obtuse, hairy at base, toothed at the apex, smooth above; ovaries lanceolate-subulate, stalked, smooth; style cleft, stigmas bifid, obtuse. Outer bud-scales very hairy.—*Pursh*. II, 615; *Willd.* IV, 667.

A handsome small tree, sometimes twelve to fifteen feet high, and four inches diameter, usually smaller. The trunk³ is nearly smooth, and the bark externally much resembles that of a maple. The small branches are smooth, polished, and dark green. Recent shoots a shining yellow, those of the second year bronzed. The leaves have a singularly neat and definite outline, from one to two inches broad, by three and a half to five long. They are on short, compressed, smooth footstalks; ovate-lanceolate, or elliptic-lanceolate, rounded at base, tapering to a very long acuminate point; closely and sharply glandular-serrate, of a shining green above; lighter, polished and reticulate beneath. At the base of the leaf, on each side, are usually a few pedicellate glands. Stipules small, semi-circular, glandular-serrate. Buds long, compressed, on the recent shoots bright yellow. The branches, large and small, are extremely brittle near the base; indeed, every part is brittle except the recent shoots, which are tough, but less so than those of most other willows.

This is the most beautiful of the willows. Hardly ever have I experienced more vividly the sense of beauty in inanimate nature, than on coming, unexpectedly, upon a low clump of this willow, in a little islet, on the edge of Meeting-House Pond, in Westminster.

This willow is found in all parts of the State, and of New

England. Sir W. J. Hooker says it is one of the most generally diffused of all the willows in British North America, being found throughout Canada, from Lake Huron to the Saskatchewan and Jasper's Lake in the Rocky Mountains, and to the Columbia River, and as far north as Fort Franklin on the Mackenzie River. It occurs as far south as Chester County, Pennsylvania.

It has a near resemblance to *S. pentandra*, of Europe, but the leaves differ in having a much longer acumination, and in having their serratures less glandular, and the male aments and their footstalks are much shorter.

GROUP SIXTH. THE WHITE WILLOWS. *Albæ*. BORRER.

Trees of the largest size, having lanceolate, serrated leaves, with glandular serratures, long appressed, silky hairs beneath, and often above, giving to the foliage a whitish or bluish hue. Flowers loosely disposed in the catkins; stamens two; ovaries smooth.—Hooker, Eng. Fl., 418.

Sp. 13. THE WHITE WILLOW. *S. alba*. L. *Introduced*.

Figured in Sowerby's English Botany, 2430. The tree in Loudon, Arb., VII, 209.

Leaves elliptic-lanceolate, regularly glandular-serrate, acute, silky beneath, often above; ovaries ovate-acuminate, nearly sessile, smooth; stigmas short, recurved, deeply cleft; stamens two, with hairy filaments; scales short, pubescent at the margin.—*Hooker's Eng. Fl.*, p. 418.

“A native of Europe, from Norway and Sweden to the Mediterranean Sea; of the north-east and west of Asia; near all the large rivers of Russia and Livonia, especially the Irtysh, where it attains the height of a large tree.”—*Loudon*, 1523. It has long been more extensively planted throughout Britain, as a timber tree, than any other species. It grows rapidly, often to the height of thirty feet in ten years, and, in favorable situations, attains an elevation of even eighty feet and upwards. It has been extensively planted in various parts of the Continent of Europe, particularly in Russia, on the road from Moscow to the Austrian frontier.

It has also been introduced and extensively planted in this

country. I have found it in Martha's Vineyard, in Waltham, and along the roads in Berkshire.

THE BLUE WILLOW, *S. carulea*, is by some made a separate species; by some, it is considered a variety of the white. It is figured in Sowerby's English Botany, p. 2431. The only characters, by which it is distinguished from *S. alba* are, that the under surface of the leaves is less silky, often quite smooth, and that the leaves have a bluish hue, deeper than that of the white. It has been extensively introduced, and is found in many parts of the State; and so readily does it propagate itself, that the blue willow, with others of the same group, fringes the beautiful Housatonic, in the midst of wildness and of cultivation, from its source to the sea.

This willow is considered preferable, on account of the rapidity of its growth, to the white.

Sp. 14. THE YELLOW WILLOW, OR GOLDEN OSIER. *S. vitellina*. L. *Introduced*.

Figured in Sowerby's English Botany, 1389. The tree in Loudon, Arb., VII, Plate 206.

Leaves lanceolate, acute, with glandular serratures, acuminate, glaucous and more or less silky beneath; often so, but usually smooth above; stipules minute, lanceolate, deciduous, smooth; ovaries ovate-lanceolate, sessile, smooth; scales linear-lanceolate, acute, fringed at the base, longer than the pistil; style short, stigmas deeply cleft.—*Hooker's British Botany*, 419; *Loudon*, III, 1528. Differs from the white in its longer, more taper aments, lanceolate, pointed scales, smooth filaments, smoother leaves, and conspicuously in its bright yellow branches.

This is a native of Britain and various other parts of Europe, where it is extensively cultivated as an ornamental tree, and as an osier, and grows sometimes to the height of fifty or sixty feet.

The golden osier has been more extensively propagated in New England than any other foreign willow. It is found in many parts of Maine, where it sometimes attains a height of thirty feet, in New Hampshire, Vermont, Connecticut, and all parts of Massachusetts. As it grows here, the trunk is rarely

erect, but inclining to one side, with a darkish bark furrowed, on old trees, with pretty deep furrows. The branches are very spreading, of a whitish green, with long dark cracks. The smaller branches are of a greenish yellow, and smooth. The terminal shoots are long, slender, dependent, of a bright yellow color. The leaves are long, lanceolate, finely serrate, tapering at both extremities, of a polished green above when mature, whitish-glaucous beneath, more or less covered with silky hairs when young. The footstalk is short, often with a dark gland at the base of the leaf on each side.

Sp. 15. THE WEEPING WILLOW. *S. Babylónica*. L. *Introduced*.

The tree is figured in Loudon, VII, Plate 207.

Leaves lanceolate, acuminate, finely serrated, glabrous, glaucous beneath; stipules minute, roundish; aments opening with the leaves; ovaries ovate, sessile, glabrous; branches pendulous.—*Pursh*. II, 614; *Willd*. IV, 671; *Loudon*, III, 1507.

A native of the banks of the Euphrates, near Babylon, of China, and of the north of Africa. It is supposed to have been introduced into Europe by the celebrated botanist, Tournefort, the great predecessor of Linnæus. Tournefort returned from his voyage to the Levant in 1702, at which time this willow must have been introduced. It is now extensively cultivated, as an ornamental tree, in those parts of Europe, as well as Asia, the north of Africa, and America, whose climate is favorable to its growth. It is almost every where considered a funereal tree, and has, in many places, taken the place of the cypress, in church-yards. To no other willow does the descriptive line of the poet of nature so well apply:—

—————“and gracefully

The willow, a perpetual mourner, drooped.”

It is found in most parts of New England, although the climate is rather too cold for it, as is shown by the fact that the branches often fail of ripening their wood, and are consequently killed by the succeeding winter.

A singular variety of this willow called the *ring-leaved* willow, with curled or twisted leaves, is cultivated as a curiosity.

Sp. 16. THE BLACK WILLOW. *S. nigra*. Marshall.

Leaves figured in Michaux, Sylva, III, Plate 125, fig. 1, and in Annals of Botany, II, Plate 5, fig. 5.

Leaves lanceolate, rounded at base when young, afterwards acute at each end, smoothish and green on both surfaces, the upper surface of the footstalk and mid-rib downy; stipules roundish-heart-shaped, pointed, deciduous; aments rather long, lax, villous, flexuose, expanding with the leaves; filaments four to six, bearded at base; scales small, oblong, spreading, very hairy; ovaries on a short stalk, brown, ovate, smooth; style short, stigmas notched; young shoots puberulent.—*Hooker, Fl., Bor. Am.* II, 148; *Darlington*, 559; *Pursh*, II, 614; *Muhlenberg, Ann. of Bot.*, II, 65.

A small tree, eight or ten feet high, growing usually on the edge of streams and lakes, and bending over the water. The twigs are light green, downy, rendered slightly angular by the continuance downwards of the vessels of the leafstalk. Leaves lanceolate, very downy and acute when young, afterwards lengthening much, tapering to a long point, and becoming smooth, often somewhat falcate, serrate, the serratures glandular, green on both surfaces, finally smooth, except the mid-rib above, and sometimes below. Footstalks short, hairy, sometimes with ferruginous glands near the base of the leaf.

Flowers in May; capsules ripe in June. This willow becomes larger, further south. *Darlington* says it is, in Chester County, Pennsylvania, fifteen to twenty feet high, with a diameter of from eight to fifteen inches, and a dark-colored, rough bark, with a stem often crooked or leaning.

Dr. Barratt says that, at Middletown, Connecticut, "The young leaves, in flowering time, are often subcordate at the base, and distinguishable by the white pubescence along the mid-rib, and on the young leaves. In Autumn, the leaves are glabrous, narrow, and mostly falcate. The fine twigs of this species are exceedingly brittle at the base. It is known to basket-makers as the 'wicker willow,' and is much esteemed for its great elasticity, in fine kinds of wicker work. It approaches the nearest of any of the native willows to *S. triandra*, of Europe. This is the last of the willows to flower. The capsules ripen in about a calendar month; and this as a general rule will apply to the rest of the willows, varying but little in ordinary

seasons. Flowers May 18th; capsules ripe June 18th."—*Salices Am.*

Michaux says this is the most common of American willows, that it is multiplied particularly in the Middle and Western States, and is found along the banks of the large rivers. He found it sometimes thirty or thirty-five feet high and twelve or fifteen inches in diameter. "Upon the trunk the bark is grayish, and finely chapt; upon the roots it is of a dark brown, whence may have been derived the specific name of the tree. The roots afford an intensely bitter decoction, which is considered in the country a purifier of the blood, and a preventive and remedy for intermittent fevers."*

Sp. 17. PURSH'S WILLOW. *S. Purshiana*. Sprengel.

The leaves are figured as those of the Champlain willow, by Michaux, Sylva, III, Plate 125, figure 2.

Leaves very long, linear-lanceolate, often falcate, gradually tapering above to an extremely long, slender acumination, acute or somewhat rounded at base, closely serrate, of a uniform green on both surfaces, and smooth, the younger leaves, particularly on the mid-rib, silky; stipules large, broad-lunate or reniform-cordate, serrate, often deflexed; female aments rather long, many-flowered, somewhat lax; scales deciduous; ovaries ovate, acuminate, stalked, smooth; style very short; stigmas slightly notched; twigs at first silky, soon very smooth.—*Darlington*, 560; *S. falcata*. *Hooker, Fl. Bor. Am.*, II, 149. *Pursh*, II, 614.

This species has a strong resemblance to the last, but may be distinguished by the very long, falcate leaves, and large cordate or broad-lunate, usually persistent stipules.

Pursh's willow is a slender tree, growing on the banks of streams and lakes, in situations sometimes overflowed, conspicuous for its remarkably soft and delicate foliage and graceful head. It sometimes attains to the height of forty feet, from a base of but four or five inches in diameter. It is often much larger. On the banks of the Nashua River, in Lancaster, I measured many stems a foot in diameter, and one, which, at the height of one foot from the ground, was five feet and eight inches in circumference, or nearly twenty-two inches in diam-

* N. A. Sylva, III, 78.

eter. The trunk is covered with a very rough, scaly bark. The recent branches are of a yellowish green, somewhat downy, the older ones grayish. The leaves are on a very short footstalk, silky-downy above. They are very long and narrow, scythe-shaped, lanceolate, rounded or somewhat acute at base, tapering gradually to an extremely long point, finely glandular-serrate, smooth and shining, and of the same color on both surfaces, which are, by the twisting of the petiole, presented almost equally to the light. The mid-rib is slightly prominent beneath and somewhat silky above, and sometimes beneath. The venation is minutely reticulate, the secondary nerves scarcely distinguishable from the veins. Each leaf, before expanding, closely embraces those within it, and is, at that time, covered with a soft, silken down. The stipules are very conspicuous, semi-lunar or ear-shaped, auricled, pointed above, nearly embracing the new shoot, and glandular-serrate. The branches slender, extremely brittle at base, even when an inch in diameter, extremely tough above. Aments expanding with the leaves, and borne on the end of a short, leafy branchlet, two inches long, and having, on its lower half, four or five short leaves. On the female ament, the scales are soon gone, exposing the brownish, downy, but not silky stem; the seed-vessels are nearly sessile, ovate acuminate, yellowish green, finally light-brown, terminated by the two nearly sessile, black stigmas; ripe, in Worcester County, in the beginning of July, or before. In Middletown, according to Dr. Barratt, the flowers expand May 18, and the capsules are ripe June 18. He says that this tree is there smaller than the black willow, and the twigs are finer; and that the twigs are equally valuable, for fine wicker work, with those of that willow. Pursh's willow is a more northern tree than the black.

The effect of the mass of foliage of Pursh's willow, in the situations in which it is found, is striking and agreeable. The softness of the light reflected from it, without the changeableness, distinguishes it from the other willows; and the great length and slenderness of the stem give a peculiarly gentle motion to the whole mass, when acted on by the wind.

GROUP SEVENTH. THE OCHRE FLOWERED WILLOWS. *Fulvæ*. Barratt.

Male aments rather short, cylindrical, expanding with the leaves, tawny or ochre-colored ; scales yellow ; stamens two, long, diverging, expanding first from the base of the ament. Female aments lax, finally lengthened ; ovaries on long stalks, silky, narrow-lanceolate. A shrub with dichotomous branches and tough twigs.—Barratt.

Sp. 18. THE BEAKED WILLOW. *S. rostrata*. Richardson.

Branches erect, rather close, pubescent, finally smooth ; leaves broad or obovate-lanceolate, acute, very entire, serrate, submembranaceous, becoming subcoriaceous, rather naked above, glaucous and whitish-downy beneath ; stipules semicordate, dentate ; male aments rather short, cylindrical, dense-flowered ; female at last very long and lax ; scales oblong, membranaceous, hairy at the apex, nearly as long as the stalk ; ovaries narrow-lanceolate, silky, with a long acumination, on a very long stalk ; style very short ; lobes of the stigma notched or entire.—*Richardson*, Appendix, p. 37, as quoted by *Hooker, Fl. Bor. Am.*, II, 147.

This is a distinct and well characterized willow, found growing in every variety of soil, more frequently in dry, but flourishing best in one moderately rich and moist, in open woods, or by the sides of forests. It is a shrub or small tree, from three or four, to ten or twelve, or even fifteen feet high.

The stem is reddish or olive-green, or gray, striated, with an orange-grayish, or clay-colored epidermis. The shoots are downy, of a reddish purple, or yellowish, or reddish above, where exposed to the sun, and green beneath. In drying, they turn to a brown or dark purple. The leaves are on short, downy footstalks ; obovate, oblong-elliptical, or broad lanceolate, often inequilateral, rounded or tapering at base, acuminate on the ends of the branches and recent shoots, with the acumination turned half round ; near the stem, shorter and broader, pointed, or obtuse ; downy, or smooth, but with the surface always conspicuously netted with depressed veins above, and white-downy beneath. Margin entire or waved, crenulate or serrate, the serratures ending in a black point. The stipules are ear-shaped, often nearly entire, sometimes cleft to the base,

sometimes toothed, and pointed above and below, or serrate. The leaves, when young, are downy on both surfaces.

This willow seems to be nearly allied to *S. tristis*, through the variety called by Pursh *S. recurvata*; and connects them with *S. conferta*. Had it not been for the high authority of Dr. Barratt, I should have associated this with the cinereous group.

GROUP EIGHTH. THE CORDATE WILLOWS. *Cordata*. Barratt.

Aments slightly stalked, ovate, cylindrical, expanding with the leaves. Scales subciliate, red or yellowish. Stamens two or three. Ovaries stalked, smooth. Leaves cordate, or attenuate at base, smooth. Stipules half-heart-shaped, serrate. Tall shrubs with dichotomous, flexible, smooth branches.—Barratt.

“The aments in this section are invested with a double covering; the outer being a hard scale or shield; the inner, a thin membranous envelope. This last is generally ruptured transversely, and is elevated like a cap or calyptra on the summit of the expanding ament. This membrane is sometimes found adhering to the inner surface of the hard scale or shield. It is most perfectly formed in *S. Torreyana*, and next in *S. cordata*. Both these species of willow begin to expand their filaments at the apex of the aments. The floral leaves (four or five) are from half to three quarters of an inch long. The fertile aments of *S. rigida*, the largest of this section, when ripe, form a densely fruited raceme three to four inches long. The mature germen are sub-rhomboidal at the base, and somewhat flattened, varying in color from green to a reddish brown.”—Barratt.

Sp. 19. THE HEART-LEAVED WILLOW. *S. cordata*. Willdenow.

Leaf figured in Annals of Botany, II, Plate V, fig. 3.

Leaves oblong, lanceolate, acuminate, heart-shaped, rarely acute at base, sharply serrate, smooth, paler beneath; stipules large, ovate-roundish, cartilaginous-serrate; aments expanding with the leaves; stamens about three; scales lanceolate, woolly, black; ovaries stalked, lanceolate, smooth; style very short; stigmas cleft.—*Hooker, Fl. Bor. Am.*, II, 149. *Pursh*, II, 615. *Willdenow*, IV, 666. *Muhlenberg, Ann. Bot.*, II, 64.

This is a beautiful low tree, varying from eight or ten, to twelve or fifteen, and even twenty or more feet in height.

Stem brown, or, on older stalks, ashy-gray or clay-colored. Branches greenish brown, or bright green, or bronze yellow, smooth; recent shoots varying, on the same stem, from bright to faint yellow, dusty or downy white, and apple-green. Buds yellow, tipped with reddish, downy. Leaves usually somewhat crowded, and then very cordate at base, at other times scattered, and rounded at base; folded back, in the bud, covered with silky pubescence when young, smooth above, glaucous beneath when mature; flat, waving, or recurved. ovate-lanceolate or broad-lanceolate, tapering to a somewhat long point. Male aments an inch long; female, one and a half inches.

This willow is found on the streams of Canada as far as the Saskatchewan. It abounds on the Connecticut, Nashua, and other rivers of this State, and is found in New York, and as far south as Virginia, presenting some remarkable varieties. The roots form large, tangled masses, on the sides of streams, and are much larger than the stems proceeding from them. Dr. Barratt says it furnishes excellent twigs for basket-work.

Sp. 20. THE STIFF-LEAVED WILLOW. *S. rigida*. Muhlenberg.

Leaf figured in Annals of Botany, II, Plate 5, fig. 4.

Leaves oblong-lanceolate, acuminate, subcordate at base, stiff, smooth, sharply serrate, the lower serrature elongate, with a cartilaginous point; foot-stalks rather long, hairy; stipules large, cordate, obtuse, glandular-serrate; aments expanding with the leaves; stamens about three; scales lanceolate, black, woolly; ovaries on long stalks, lanceolate, smooth; style very short; stigmas bipartite.—*Willdenow*, IV, 667. *Pursh*, II, 615. *Hooker, Fl. Bor. Am.*, II, 149. *Muhlenberg, Ann. of Bot.*, II, 64.

A more vigorous or coarser looking plant than the last, resembling it very much, but distinguished by the length of its hairy petioles, the coarseness of the serration of the leaves, and the prolongation and stiffness of the lower serrature.

It is a handsome small tree, sometimes fifteen feet high. The stem is grayish, rather smooth, erect and slender, or prostrate along the banks of streams, where its large roots, with those of *S. cordata*, *S. lucida*, and *S. nigra*, form dense and strong bulwarks against the action of the stream. The branches

are grayish green, or gray; the recent shoots a bronze yellow, often clouded, brownish and downy; often bright red where exposed to much light. The lower serratures of the leaves are enlarged, prolonged and rigid.

It is found between Fort Franklin and Cumberland House, in British America, and in Pennsylvania. In this State, I have found it on the Hoosic, abundantly on the Connecticut, about the pond in Westminster from whence flows the Nashua, and along the banks of that river.

“This strong and handsome species furnishes excellent twigs and rods for the heaviest kinds of basket-work. This willow and *S. cordata* are very ornamental in groves and plantations. There are several varieties of *S. rigida*, and of the aments I have met with great diversity. The largest of these catkins are one and a half to two inches long, and when the flowering season is fine, and the catkins have escaped being drenched with rain, I have found these flowers of great beauty, exhibiting a play of colors from violet or purple to yellow; as the stamens rise over the tips of the scales from their downy bed, they yield the resplendent colors of the rainbow, and this zone is carried symmetrically onward, by the successive elongation of the filaments.”—*Barratt*.

Sp. 21. TORREY'S WILLOW. *S. Torreyana*. Barratt.

Leaves heart-ovate, sharply pointed, one and a half inches wide, four inches long; margin wavy and finely serrate; above smooth, deep green, beneath paler; stipules large, one half to three quarters of an inch broad, half-heart-shaped. Male ament slender; when expanded, one and a half to two inches long; scales imbricate, lanceolate, blackish and ciliate; stamens two, filaments rather short. Female ament, rachis slender, clothed with soft, dull white hairs. Germens on short pedicels, smooth, deltoid-lanceolate: stigma four-parted; in flowering time, flesh-colored, mature capsules green, somewhat compressed, twigs tough, smooth, greenish purple. Adult leaves coriaceous.—*Barratt*.

Flowers April 12—18 in Middletown.

Dr. Barratt named this hitherto undescribed willow in honor of his friend Professor Torrey of New York.

“This ornamental willow seldom exceeds eight or ten feet in height; and will be readily recognized in autumn from the other

willows of this fine group, by its broad, heart-shaped, glossy, deep-green leaves, wavy margin, and sharp point; also by its large stipules. The staminate plant, in flowering time, may also be distinguished by its long and slender catkins, and the absence of the irised ring or zone, exhibited by *S. rigida* and *S. cordata* in flowering time, when the anthers are elevated above their respective scales and short fine hairs. The pistillate plant may also be distinguished early in spring by its delicate, flesh-colored, four-parted stigma. The leaves do not blacken in drying; it is very distinct from *S. rigida* and *S. cordata*. This is probably one of the best native willows we possess, for protecting the banks of rivers with rapid currents. It does not grow as high, and is more disposed to spread in these situations than its congeners, *S. cordata* and *S. rigida*. It furnishes abundance of stout twigs or rods."—*Barratt*.

I found this beautiful willow growing abundantly along the banks of the Connecticut, in Longmeadow and Springfield, and also on the plains between the Arsenal and Chicopee Falls. As found growing on the uplands, it is a showy plant, six or eight feet high, stem erect or bending, of a light gray color with blackish clouds. Branches long, bending upwards, of a shining gray. Twigs bronzed or yellowish-green, with a red or purplish hue above. Stipules very large, half-heart-shaped, rounded above, often folded around the leaf so as to appear double. Leaves rich and luxuriant, hearted or rounded at base, broad, oblong-lanceolate, tapering gradually to a long point; footstalks short.

There is a great resemblance between the last three willows, and it is only by very attentive study that they can be clearly distinguished. Torrey's willow has doubtless been confounded with the two previous, until Dr. Barratt, by planting them side by side, has availed himself of the opportunities thus presented of comparing them in all stages of their growth, and at all seasons.

I have specimens from Williamstown, of what Dr. Barratt tells me is *S. angustata* of Pursh, but I have had no opportunity of particularly examining the plant. I had taken it for a narrow-leaved variety of *S. cordata*.

FAMILY IX. THE BREAD-FRUIT FAMILY. *ARTOCARPEÆ*.
BROWN.

This family consists, with a single exception, of trees and shrubs, with alternate, toothed, or lobed, or entire leaves, and milky juice. They are natives of tropical regions, two or three genera, *Morus*, *Broussonétia* and *Maclura*, being found towards the north, and a single species of *Morus*, as far as Canada.

To this family belongs the famous Upas tree, *Antiaris*, of Java, which has long been considered the most deadly poison in the world. And here also, in strange companionship, are the Bread-fruit Tree, the Fig, the Mulberry, the Osage Orange, and the Fustic, a kind of mulberry whose wood furnishes the well-known yellow dye. The juice of all is remarkable for being milky, and contains a considerable portion of caoutchouc. It is, even in those that produce wholesome fruit, usually acrid and of a suspicious character, and sometimes poisonous. Yet here also we find the Palo di Vacca, the famous Cow-tree of South America, which yields a large supply of rich and wholesome milk; and the fruit of several of the plants, besides those already mentioned, are eatable. Many virtues are ascribed to the various kinds of fig. The *Ficus religiosa*, the Indian Fig, or Banyan tree of India, is justly looked upon as one of the signal favors of Providence to tropical India, furnishing to the traveller a natural temple, thick shade, and refreshing fruit.

This family is distinguished by having its fruit usually situated on or within a fleshy receptacle, covered by numerous nuts or drupes,—rarely a single one,—enveloped by a fleshy or pulpy involucre, and forming a compound fruit, like many berries or fleshy fruits grown together. The name *Artocárpeæ*, was given by De Candolle to a section of the nettle family, to indicate the most important tree of this group, (the *Artocarpus*, literally bread-fruit,) and the fleshy character of the fruit.

The genera that are found native or cultivated in this climate are *Morus*, *Broussonétia*, and *Maclura*. The only one native is,—

THE MULBERRY TREE. *MORUS*. L.

The flowers of the two sexes are usually on the same plant, sometimes on distinct plants. The male flowers are in a drooping, axillary spike, with a calyx of four-parted sepals and four stamens. Female flowers in ovate, dense, erect spikes; calyx of four sepals, concave, becoming pulpy and juicy. Ovary of two cells, one having one pendulous ovule, the other none. Stigmas two, long. When ripe, each ovary is a fleshy nut covered by the fleshy calyx; the aggregate from a spike of flowers forming the compound *berry*.

The several species are trees, with white sap, and alternate, rough, usually lobed, leaves, which are the favorite food of the silk-worm, the caterpillar of the *Bombyx Mori*, but are hardly attacked by any other insect. There are ten or more species, two of which have been known from remote times.

The only species natural to New England, is—

THE RED MULBERRY. *M. rubra*. L.

Figured in Michaux, Sylva, III, Plate 116; and in Loudon's Arboretum, VII, Plate 183.

This species naturally grows farther north than any other mulberry. Pursh speaks of it as growing in the Middle States; Michaux thinks it is not found east of the Connecticut River, or north of Lake Champlain. According to Darlington, it sometimes reaches the height of thirty feet in Pennsylvania, and a diameter of from twelve to twenty inches, with numerous spreading branches at top. But Michaux found it, in the upper part of that State and in Virginia, sixty or seventy feet high, and sometimes two feet in diameter. According to all who have spoken of it, the wood is exceedingly hard, strong, and durable. Michaux says it is almost as durable as the locust, and by many persons esteemed quite equal to it. In the southern ports, all that can be obtained of it is employed in ship-building, and it is preferred to every other wood except locust, for treenails. For posts, also, it is highly valued, from its durability when exposed to the weather. In boat-building, and for

the light timber of vessels, it is preferred in Carolina to any wood except the red cedar.*

The use of its leaves as food for silk-worms, has been tried, but not with encouraging success. The fruit is very agreeable, and by most persons is preferred to that of any other species.

I have found it growing wild on the Westfield River, where it is a small tree about twenty feet in height, like an apple tree. The recent shoots are gray, and somewhat downy. Larger branches, a light gray or brownish buff, smooth, with prominent gray dots. Trunk rough, with long superficial clefts and furrows. The leaves are heart-shaped, ovate or three-lobed, ending in a long point, rough on the upper surface, and downy on the lower.

The Black Mulberry, *M. nigra*, L., is occasionally cultivated here, as it has been in most parts of the civilized world from very ancient times, for ornament, and for its shade. It is supposed, from the circumstance of its being found, in great numbers, wild in the forests of Persia, to have been originally a native of that country, and to have been introduced thence, at a very remote period, into Europe; and others think it probable that it was brought, at a still more remote period, into Persia, from China. Its leaves are of no great value as food for the silk-worm, and its wood has not much strength or durability.

Several of the numerous varieties of the White Mulberry, *M. alba*, L., have been introduced, and are much cultivated in this country, with reference to the production of silk, the leaves having been long considered the natural and best food for the silk-worm. None of the varieties are so hardy as the black and red mulberries—and their range of climate is much less extensive. Its native country is China; but it has been naturalized in several parts of Europe, and it flourishes in all the temperate parts of this continent. It is a rapidly growing tree, reaching the height of twenty feet in five or six years, and when fully grown, attaining that of thirty or forty feet.

The Many-stemmed Mulberry, *M. múlticaulis*, is a native of China, where it is said to be preferred for the food of silk-

* Elliott.

worms. Perrottet brought it from Manilla to Senegal in 1821, and, some years afterwards, to Europe. It has been extensively propagated in this country, and affords a great abundance of more delicate leaves than those of any other mulberry; and the silk formed by worms feeding on them, is considered very excellent, perhaps superior to any other.

The Paper Mulberry, *Broussonètia papyrifera*, so much resembles a mulberry tree in its general appearance, that it has until recently been included in that genus. It is a low, thick-branched tree, with large, light colored, downy or hairy leaves, and dark scarlet fruit. It is very hardy, grows rapidly, has considerable beauty, and might be introduced as an ornamental tree, but is of no value for its wood. It receives its specific name from the fact that, in Japan and China, of which it is a native, its bark is manufactured into paper. In the South Sea Islands, where also it is found, the bark is made into the curious dresses which we sometimes see imported thence.

THE OSAGE ORANGE, *Maclura aurantiaca*, is a native of the banks of the Arkansas, and other regions west of the Mississippi. Its name was given by Nuttall in honor of William Maclure, a liberal and distinguished patron of the Natural Sciences in North America. It is a beautiful, low, spreading, round-headed tree, with the port and splendor of an orange tree. Its oval, entire, pointed leaves, have the polished, shining green of natives of warmer regions, and its curiously tessellated, succulent, compound fruit, the size and golden color of an orange.

The male and female flowers, which are green and inconspicuous, are found on different trees; and different kinds must grow in immediate vicinity, in order that the fruit may be fertile. In the neighborhood of Philadelphia, I saw, in the Autumn of 1839, some fine specimens of this tree, several of which were loaded with fruit. I have rarely seen an object in the vegetable world more strikingly beautiful.

It was first introduced into St. Louis from the country of the Osage Indians, and thence received the name, which it well deserves, of Osage Orange. It has since been cultivated in many

parts of this country and Europe, and has ripened fruit in several places in the south of France. It seems to be perfectly hardy in the latitude of Boston, as, at Nonantum Hill, in Newton, it has been found by Mr. Kenrick to have endured without injury the rigors of the last ten winters.

The wood seems likely to be of great value. It is of a rich saffron yellow, whence it is sometimes called Yellow Wood, and resembles the *Maclura tinctoria*, a tree of the West Indies, in yielding a yellow dye. It is of a fine close grain, and very elastic, and is preferred by the Indians, to make their bows with, and thence called Bow Wood. It is hard and durable, and is said to receive a beautiful polish. It must therefore be valuable to cabinet-makers. It is said to rival even the live oak in durability as ship timber. From the bark, as from that of the Paper Mulberry, a fibrous substance resembling fine white flax, may be formed. The use of its leaves as a substitute for those of the White Mulberry for feeding silk-worms, seems to be of doubtful success.

It is easily propagated by layers, and by cuttings of the root. Loudon says that, in the vicinity of London, a plant cut down after having been two or three years established, throws up shoots six or eight feet high, and nearly half an inch in diameter, in a single season.

CHAPTER III.

PLANTS WHOSE FLOWERS ARE WITHOUT PETALS, AND NOT ARRANGED
IN AMENTS.

FAMILY X. THE ELM FAMILY. *ULMACEÆ*. MIRBEL.

THE members of this family, several of which, in our own country, are among the noblest and most valuable timber trees, are natives of the northern temperate regions of both continents, being found in North America and Europe, in China, and the other northern countries of Asia, and in the mountains of India. They are allied, botanically, to the Nettle Family on the one hand, and to the Bread Fruit on the other, however different they may be in their general aspect. They are not distinguished by any remarkable properties. The bark of several species is tough and fibrous, and susceptible of being used for rude cordage; the substance which exudes spontaneously from the bark of the elm, and thence called ulmin, is also found in that of the oak and chestnut, and is said by Berzelius to be a constituent of most kinds of bark. The plants belonging to this family are trees with simple, serrate, roughish, unequal-sided leaves, which are usually alternate in two rows on the sides of the branches. The flowers are in fascicles on the sides of the branchlets, and furnished usually with stamens and pistils, but sometimes wanting the latter. The flower-cup is erect, somewhat bell-shaped, with its border divided into four, five, six, or eight lobes. The stamens spring from the bottom of the cup, and are usually of the same number as the lobes, and opposite them. The ovary has one cell and one ovule, and is crowned with two styles. The fruit is a flattened, winged samara, or a drupe.

There are two genera found in this State, the Elm, *Ulmus*, whose fruit is a samara; and the Nettle Tree, *Celtis*, whose fruit is a stone fruit or drupe. A third genus, *Planera*, is found in the Southern States, and might be cultivated here.

1. THE ELM. *ULMUS*.* Linn.

The elms are all long-lived trees, with hard wood, consisting of twisted and interlaced fibres, alternate, deciduous, harsh, serrated leaves, inequilateral at base. The flowers come out, early in the Spring, before the leaves, in small, dark-red, fringe-like tufts, and are soon succeeded by the peculiar fruit called a samara, consisting of a small, central, thin membrane, containing a seed, and bordered by a thin, wing-like margin. This becomes mature and falls, when the leaves are expanding. The buds are covered with six or seven coriaceous scales, overlying each other in two rows; those which contain flowers are large and arranged on the sides of the branchlets of the preceding year. The leaves have short stalks, are rough, unequally and doubly serrate, acuminate, and vary much in size and shape. So are the membranaceous stipules, a pair of which embrace each leaf within the bud, and at the same time protect the leaves which are to succeed from the same bud. The roots of most of the species are strong, very tough, supple, and spreading extensively beneath the surface. When raised from seed, the different species have a striking tendency to vary, and in Europe, where, for its uses in agriculture and the mechanic arts, and for ornament and shade, it has been constantly cultivated since the time of the Romans, the varieties are very numerous. The same tendency may be observed, in the variation of shape and habit, in the native elms of different parts of New England, and even of Massachusetts.

Their growth is rapid; they bear transplanting and pruning better than almost any other tree; they grow on almost any soil, and have a great variety of beauty, and their timber is valuable for many purposes, and bears continual exposure to moisture without decay. Perhaps, therefore, no trees are greater favorites, or more deservedly so. On the continent of Europe, where the variety of forest timber trees is much smaller than in America, the elm is applied to a great number of uses, for which other trees

* The Latin word *Ulmus* is supposed to be derived from the Saxon word elm or ulm, which is given as the name of this tree in almost every Saxon dialect.

are here preferred, as the wood has the disadvantage of being liable to warp and shrink, unless very long and thoroughly seasoned, or kept moist. Both living and dead, it is liable to the attacks of insects and worms, which strip it of its foliage, penetrate into its bark and wood, and lessen the value of its timber.

A great many insects feed upon its leaves. The most pernicious, if not the most universal of these, are the canker-worms, (*Anisopteryx vernata* and *pometaria*) one or two species of which, with their habits, times and mode of destruction, have been carefully described by Dr. Harris, (Report, p. 334—341.) Less injurious are the span-worms, called, when arrived at their perfect moth state, *Hybernica tiliaria*, the Lime-tree winter-moth, (ib., pp. 341, 342.) The *Cimbex ulmi* a species of saw-fly, (ib., pp. 374, 375,) feeds on the leaves of the elm, during its caterpillar existence, and the caterpillars of some of the most beautiful of the moths and butterflies, such as the stinging caterpillars of the *Saturnia* moth; (ib., p. 283,) the caterpillars of the *Antiopa* butterfly, (ib., p. 219,) of the Semicolon butterfly, *Vanessa interrogationis*; (ib., p. 220,) of the Progne butterfly, *Vanessa progne*, (ib., p. 222,) and the enormous caterpillars of the *Ceratomia quadricornis*, which are sometimes three inches and a half long, (ib., p. 227), are all found on this tree, and do more or less harm by devouring its leaves.

There are two species of elm common in Massachusetts, the American, and the Slippery Elm; another is sometimes found indigenous; and two varieties of the European Elm have been introduced.

Sp. 1. THE AMERICAN ELM. WHITE ELM. *Ulmus Americana*. L.

The American elm is, in most parts of the State, the most magnificent tree to be seen. From a root, which, in old trees, spreads much, above the surface of the ground, the trunk rises to a considerable height in a single stem. Here it usually divides into two or three principal branches, which go off by a gradual and easy curve. These stretch upwards and outwards with an airy sweep,—become horizontal, the extreme

branchlets, and, in ancient trees, the extreme half of the limb, pendent, forming a light and regular arch. This graceful curvature, and absence of all abruptness, in the primary limbs and forks, and all the subsequent divisions, are entirely characteristic of the tree, and enable an observer to distinguish it in the winter and even by night, when standing in relief against the sky, as far as it can be distinctly seen.

The American elm affects many different shapes and all of them beautiful. Of these, three are most striking and distinct. The tall Etruscan vase is formed by four or five limbs, separating at twenty or thirty feet from the ground, going up, with a gradual divergency to sixty or seventy, and then bending rapidly outward, forming a flat top with a pendent border. Such is the fine old tree, still in perfect vigor, which stands by the painted* gate of the Botanic Garden, in Cambridge. And such are many of the noble trees in Northampton and Springfield, and all along the valley of the Connecticut.

The single or compound plume is represented by trees stretching up in a single stem, or two or three parallel limbs, to the height of seventy or even a hundred feet, and spreading out in one or two light, feathery plumes. Of this character is the tall, patriarchal tree that stands alone on the common in Pittsfield. Many specimens of this form may be seen in Berkshire and in other parts of the State where the tall primeval forest has been cut away, and the elm alone has been left standing.

The elm often assumes a character akin to that of the oak; this is when it has been transplanted young from an open situation, and allowed always to remain by itself. It is then a broad, round-headed tree. Of this kind are the large tree on Boston Common, the grand old tree by the Aspinwall house in Brookline, and that striking tree, in Hingham, on the road to Cohasset. The resemblance to the oak, however, never very striking, is entirely lost as you approach and stand under it. The mighty, abrupt strength of the oak is not visible, and you have, instead, the graceful majesty of the elm. "The buttonwood," says Michaux, "astonishes the eye by the size of its trunk and the amplitude of its head; but the white elm has a more majestic appearance, which is owing to its great elevation, to the

disposition of its principal limbs, and to the extreme elegance of its summit. In Maine, between Portsmouth and Portland, a great number of young white elms are seen detached in the middle of the pastures; they ramify at the height of eight, ten, or twelve feet, and their limbs, springing at the same point, cross each other and rise with a uniform inclination, so as to form of the summit a sheaf of regular proportions and admirable beauty."

The character of the trunk is almost as various as that of the general form of the tree. You sometimes see it a straight, gradually tapering column, shooting up to sixty or eighty feet without a limb; at other times, an inverted small branch or two, pushing out at the fork, hangs waving downwards for some feet. Again you see it a verdant pillar of foliage, feathering from the branches to the ground.

With this endless variety of beauty, it is not wonderful that the American elm should be the greatest favorite with the New England people. And it has the additional recommendation of retaining much of its beauty when the foliage is gone. The sturdy trunk and the airy sweep of the branches are always there, and few objects of the kind are more beautiful than the feathered, alternate regularity of the spray upon the outmost and uppermost boughs. With the earliest spring, these are fringed with numerous bunches of red blossoms, soon to give place to soft, delicious green of the young leaves.

Coming with such recommendations, the elm is more frequently transplanted than any other forest tree, and, from the vigor and number of its roots, it is more sure than any other to live. It is oftener spared, too, in most parts of the country, when the rest of the forest is cut away. We frequently, therefore, see it standing, for a shade to cattle, in pastures, and by fences and sometimes in mid fields, on tilled land, or left to shade and protect and give an air of comfort to farm-houses. And, in the excellent practice, becoming every year more common, of ornamenting towns and villages and sheltering sunny roads, with rows of trees, the elm is chosen often to the exclusion of all other trees, of trees too, which, much as we value the elm, we cannot but consider its equals and often its su-

periors, the maples, the ashes, the birches, the beeches, and even of the lordly oak itself.

But the elm bears pruning better, and requires it less than almost any tree, for it usually throws out no branches below a height of twelve to twenty or thirty feet. It grows, too, with great rapidity, for its roots run, just beneath the surface, to a great distance, and thus get the best of the soil.

The flowers are in numerous clusters of from eight to twenty in a cluster, on the sides of the terminal branches. Each flower is supported on a green, slender, membranous thread, from one fifth to half an inch long, and consists of a brown cup, parted into seven or eight divisions, rounded at the border, and containing about eight brown stamens, and a long, compressed ovary, surmounted by two short styles. This ripens into a flattened seed-vessel, called a samara, which is winged on every side, with a thin, ciliated or fringed border. The flowers appear early in April or even in March, and the samaræ are mature before the full expansion of the leaves.

The leaves are on very short footstalks, broad ovate, heart-shaped, rounded or rarely acute at base, acuminate, conspicuously doubly serrate; divided by the mid-rib into very unequal parts, of which the upper is larger; somewhat tomentose when young, afterwards roughish on both surfaces, particularly the upper; usually from two to four or five inches long, and one and a half to two and a half broad, but varying extremely in size. The rich green of the leaves turns, in autumn, to a sober brown, which is sometimes touched with a bright golden yellow.

The elder Michaux found the elm as far north, in Canada, as $48^{\circ} 20'$. According to Hooker, it is found from Saskatchewan to York Factory, on Hudson's Bay. The younger Michaux traced it from Nova Scotia to Georgia, and says that it is found in the extreme western part of the country. He considers the country between the 42° and 46° of latitude as most favorable to its growth. To this, probably, no part, considering the soil, is better adapted than Massachusetts. This tree grows in almost any soil, but never attains its loftiest elevation except in rich, moist ground, such as is found on the banks of our larger rivers. In such situations, it has so rapid a growth, that

he who has planted it may live, without passing beyond the ordinary age of man, to see it become a majestic tree. I once heard an old man, standing in the shade of a tree, nearly two feet in diameter, which towered above all around it, say, "this tree, after I had been many years successful in business, and, in a change of fortune, had retired to this farm with a little that remained, I stuck into the ground after I had used it as a stick, in a ride of eight miles home from P——." I know several fine rows of majestic elms, the ornaments of the villages where they grow, that were transplanted within the distinct memory of persons now living to enjoy their shade.

From its having been so long a favorite, it has been more frequently spared and oftener transplanted than any other tree, and there are, in all parts of the State, many fine old trees standing. Of a few of those, which I have had an opportunity to examine and measure, or of which I have received an account, I give some of the dimensions.

In Springfield, in a field a few rods north of the hotel, is an elm which was twenty-five feet and nine inches in circumference, at three feet from the ground, when I measured it in 1837. This magnificent tree divides, not many feet from the ground, into several large branches. This is near the place where the enormous Celtis, which was usually taken for an elm, once stood. There are many other elms, not far from this, some of which make a greater show at a distance.

In West Springfield, the largest tree I could see, upon the road, measured, at the same time, nineteen feet five inches in girth at four feet from the ground.

At Richmond, I measured, in 1837, with William Bacon, Esq., an elm in the northern part of the town, which was twelve feet two inches in girth, in the smallest part, between the root and branches. This was of the kind resembling a sheaf of wheat.

The Pittsfield elm was, in the same year, thirteen feet in circuit at four feet. This towers up to one hundred and fourteen feet, without a branch, till near the top.

In the lower part of Bolton, I measured a tree which was fifteen feet seven inches, at four feet from the ground.

The Aspinwall elm, in Brookline, standing near the ancient

house belonging to that family, and which was known to be one hundred and eighty-one years old in 1837, then measured twenty-six feet five inches at the ground, or as near to it as the roots would allow us to measure, and sixteen feet eight inches at five feet. The branches extended one hundred and four feet from southeast to northwest, and ninety-five from northeast to southwest.

The great elm on Boston Common was measured by Prof. Gray and myself, in June of 1844. At the ground, it measures twenty-three feet six inches; at three feet, seventeen feet eleven inches, and at five feet, sixteen feet and one inch. The largest branch, towards the southeast, stretches fifty-one feet.

The classical elm, opposite the gate of the Botanic Garden, Cambridge, measured fourteen feet nine inches at four feet, in 1838.

In Hingham, on the road leading to Cohasset, just below the turn from the Old Colony House, stands an elm which is said to have been transplanted in 1729. It may have been one hundred and twenty or one hundred and twenty-five years old, on the 25th of July, in 1839, when I measured it, in company with that excellent botanist, William Oakes, Esq., of Ipswich. It was thirteen feet in circumference, at four and a half feet from the ground. At from ten to fifteen feet, eight large branches are thrown out, which sweep upwards in a broad curve, making a noble round head sixty or seventy feet high. The immense roots, which, beginning at three or four feet above the surface, stand out like abutments, in all directions, chiefly west and east, give an idea of permanency and vast strength. The extreme spread of the limbs is forty-five feet from the trunk, making the breadth of the head more than ninety feet. In the angle of one of the branches, when we measured it, was growing a currant-bush with ripe fruit. Speaking of this tree, J. S. Lewis, Esq., to whom I am indebted for valuable information concerning the trees of Hingham, says,—“At ten feet, it is fifteen feet nine inches in circumference. It has a hemispherical top, of ninety feet diameter at the base, ascending and terminating with singular uniformity, presenting to the eye a rare combination of beauty and grandeur. At this measure-

ment, it is covered with a deep, luxuriant foliage, looking as fresh and vigorous as a stripling of the forest."

In July, of 1838, I measured the noble elm which stands in front of the dwelling-house of Capt. Jaquish, about one mile from the centre of Newburyport. This was set out in 1713, by Richard Jaquish, who was born in 1683. It may, therefore, be one hundred and thirty-five or one hundred and forty years old. At the smallest place between the roots and the branches, it was fifteen feet in circumference, and probably over eighty feet high. It had many large branches, one of which was more than three feet in diameter.

Mr. William Bacon, of Natick, mentions two remarkable elms growing in that town. "One of them is not far from the Old Hartford road, near South Natick Mills. Its pendent branches are spread equally in all directions, to the distance of fifty feet from the trunk, thus giving a diameter to its shade of about one hundred feet. It is the handsomest specimen of its genus which I ever saw."

"The other is standing upon the south side of the road which leads from Natick to Wayland, near the house of Mr. Edward Hammond. This tree was transplanted to its present situation about sixty years since, under the superintendence of the gentleman who still occupies the mansion. It now, (1838,) measures thirteen feet in circumference four feet above the ground, and probably twenty or more at the surface. Its shade measures, from north to south, at noon-day, one hundred and two feet. It ramifies at the height of about eight or nine feet."

The great Sheffield elm had, in September, 1844, at the ground, a girth of twenty-two feet six inches; at two feet, eighteen feet six inches; at three, sixteen feet nine inches; at four, fifteen feet ten inches; at five, sixteen feet; at six, sixteen feet seven inches, above which it rapidly enlarges, and divides at ten or twelve feet into three large limbs, which soon subdivide. Its spread westward, from the centre, is forty-nine feet six inches, and it is nearly equal on every side; height sixty or seventy feet.

At Johnston, on the estate of Royal Potter, Esq., is a magnificent elm, which I measured, August 21, 1840, with the aid of Hon. Horace Mann. At from twelve to fifteen feet, it

throws up a prodigious weight of branches, twelve, each equal to a tree,—forming a broad, one-sided head. At five feet from the ground, which is the smallest place, its girth is twenty-two feet two inches; at seven, it is twenty-two feet nine inches; at one and a half on one side, three on the other, twenty-nine feet nine inches; at three, twenty-four feet nine inches. Below, one and a half or three, the roots bulge out. The first large branch, which has a girth of eleven feet two inches, divides into two. The second, thirteen feet ten inches in girth, divides into five branches. The horizontal extent of the southeast branch, is sixty-nine feet one inch. It is a very old tree and falling into decay, but still vigorous and clothed with a rich, dark colored foliage. Its uncommon growth is, doubtless, owing to its peculiar situation. A small perennial stream flows near it, and its most vigorous limbs are stretched so as to overshadow, for many feet, the little fertile glade through which it flows. It is also near a farmer's yard, the animals belonging to which are often standing by day or lying by night, under the covert of its branches. It has, to visitors, the additional recommendation of being on the farm of a worthy magistrate, who knows how to respect the curiosity of those who visit it.

Some of these trees are still in apparent vigor, though nearly two hundred years old. It is found, however, on cutting down old elms, that they are, almost universally, hollow at base. Whether this is the case in the rich, deep soils of the western valleys, I know not. In the scanty soils of Massachusetts, it may proceed from the fact, that all the nutriment near the bottom of the tree, where the roots are fed that nourish the heart, is exhausted.

Besides its use as a shade and ornamental tree, its timber is employed for several important purposes in the arts. Its wood is preferred to any native wood for hubs of wheels. In Boston and the vicinity, the hubs for the very superior gigs, light wagons, and other pleasure carriages, which are manufactured there, are almost universally made of it. For this purpose, it is obtained from the towns within a few miles in the neighborhood. The same use is made of it in the centre and western parts of the State. Yokes are made of it. In the sea-port

towns, it is much used for making large ships' blocks. As it is very difficult to work, these are not made, like the smaller ones which are of ash, of a single thick piece, but of several pieces of plank pinned together. From the peculiarity of the grain, these cannot be planed lengthwise, but must be wrought crosswise. By the ship-builder, it is used in the flat of ships' floors. For blocks and hubs, it is said, by those who have tried both, that English elm is decidedly superior.

Formerly, the bark of the elm was used to make chair bottoms. It has considerable tenacity, and when macerated in water and rendered supple by pounding, may be twisted into a pretty strong cord.

The elm may be very easily propagated by seed, by suckers, or by layers. The seed is ripe in May or early in June; and in August and September, I have seen thousands of young elms springing from them in the paths or sandy walks beneath, or near the tree. The seed should be sown immediately after it has fallen, on soft, sandy loam, and covered lightly to the depth of one eighth or one fourth of an inch. The plants will appear in a few weeks, and may be transplanted to a nursery the same autumn. In from five to ten years, they will be large enough to be planted where they are permanently to stand. There is so great a similarity in the habits of this and the English elm, that it might doubtless be propagated by suckers and layers, in the same manner as directed for that tree.—See pp. 302—3.

The elm is transplanted from the forest, of every size, from five or six feet to thirty or more; and it is so tenacious of life that it bears beheading and dismemberment in an astonishing manner. Far more pains in the transplantation would be well rewarded. By a little attention to the habit of the young trees, those might be selected which would push up to an ample height before ramifying: and those numerous varieties which strike us by their beauty, when seen standing as they were left on the clearing up of the woods, might be secured by examining the tendencies of the trees in particular situations.

I have measurements of very many large elms from various parts of this State. For many of them, I am indebted to the

kindness of Dr. O. W. Holmes and J. J. Dixwell, Esq. Others I have obtained from other individuals and from the New England Farmer, and a still greater number I have measured myself. In the following statistics, the words "circumference," "feet," "inches," and "from the ground," will be generally omitted:—

Three miles from Hingham, a fine tall elm measured, in June, 1840, 12 feet 7 inches at $4\frac{1}{2}$ feet. It is of the Etruscan vase shape, and a fine specimen. In the same year, an old elm at Heard's Island, in Wayland, was 20 feet at $1\frac{1}{2}$, and 15 feet 5, at $3\frac{1}{2}$. A very noble tree, 75 feet high, and with a spread of 128 feet from northeast to southwest, and not much less in any direction, covering a broad space with its dense shade. One in Lincoln, a beautifully irregular and picturesque tree, with a full, broad head, growing on the road-side, and giving a cheerful aspect to two houses, and on which a family of orioles had built their hanging nests for not less than seventeen years,—was 12 feet 9, at 5 feet. A broad, spreading tree on the Old Common in Lancaster, was 14 feet 6, at 5 feet 6. East of Centre Bridge, in the same town, on the south side of the river, by a green lane which was once a town road, a tree of 70 or 80 feet high, measured 20 feet 9, at 2 feet above the bulging of the roots. An elm near Breck's garden, one half in a wall, was 16 feet 3, at $5\frac{1}{2}$. It enlarges above and divides into many branches, spreading into a vase-like shape, with a broad, magnificent head of 80 or 90 feet in height. Several other very noble trees are near by.

The following were measured by Dr. Holmes, in September, 1837:—

Great elm, at Springfield, was 29 feet 4, at about 1 foot; 25 feet 10, at 2 or 3; 24 feet 8, at 5. A curious tree, also in Springfield, was 20 feet 1, at 1; 18 feet 5, where smallest; 22 feet 11, at 5. One on Northampton meadow, was 22 feet 2, at 1; 22 feet at 3; 23 feet 9, at 5. A second was, 19 feet 7, at 1; 16 feet 6, at 5. One in Mr. Whitney's yard, in that town, was 22 feet 2, at 1; 18 feet 7, at 5. One on Deerfield street was, 17 feet 7, at 5; another, on the Colman farm, 23 feet 9, at 1; 16 feet 7, at 5. A tree at Hatfield, measured 35 feet 9, at a little above 1; 23 feet 2, at 5; 22 feet 7, at $6\frac{1}{2}$. The elm on the Common, at Pittsfield, was 17 feet 4, at 1; and 12 feet 7, at 5. One on the Wendell farm, 20 feet at 1; 13 feet 4, at 5. Thaddeus Morse, at Medfield, had a tree which measured 37 feet 4, probably at the ground.

The following elm trees, in Northampton, were measured by Mr. Dixwell, in November, 1841:—

On the intervalle between the town and river, in "Middle Meadow," an old elm, within sight of the ferry-landing, from Mount Holyoke towards the south-

west; 6 inches from the ground, 24 feet 6, in circumference; at $3\frac{1}{2}$ feet, smallest place, 22 feet 10; at $4\frac{1}{2}$ feet, 23 feet 10. It begins to branch at $5\frac{1}{2}$ feet from the ground, and divides into distinct trunks at $7\frac{1}{2}$ feet. Its roots spread very little at the surface. The trunk seems sound outside, but the branches at, and just above, the main trunk exhibit considerable decay, and one branch, about a foot in diameter, has fallen this season. Spread of branches 110 feet. An elm, with top in fine preservation, and apparently healthy, but with a deep hollow in one side of the trunk,—at the ground, 20 feet 9; at $4\frac{1}{2}$ feet, 16 feet 10, smallest place; branches off at 8 feet from the ground. On the intervale, northeast from the ferry a mile or so, are two decayed trees, 18 and 20 feet at the smallest places. One in the same situation, in fine condition;—at 1 foot from the ground, 21 feet 4; at 2 feet, 17 feet 7, smallest place; at $4\frac{1}{2}$ feet, 19 feet 11; branches at 5 feet from ground, and spreads over an area thirty paces in diameter. Another, in the same situation, in fine condition;—at 1 foot from the ground, 18 feet 7; at 4 feet, 16 feet 8, smallest place; branches at 7 feet. A tree, called “Mather Elm,” before an old house, formerly occupied by a family of that name, on the north side of Pleasant street:—at 1 foot from the ground, 22 feet 8, roots spread much; at $4\frac{1}{2}$ feet, 15 feet 7, in smallest place; branches at 12 feet, and is in fine condition, with the exception of one large branch gone. Elm, in King street, planted by President Edwards, now before the house of J. D. Whitney;—at the ground, 22 feet 5; at 4 feet above, 18 feet 10, smallest place; branches at 7 feet and is in fine condition. One in the Main street, before the house of a Mr. Pomeroy, and opposite the mansion of the late Gov. Strong;—at 4 feet from the ground, 15 feet 1, smallest part.

Great Elm, at Hatfield, near the church, in the enclosure at the side of the town house;—at the ground, 41 feet, roots spread much; at $3\frac{1}{2}$ feet, 27 feet; at 6 feet above, 22 feet 9, smallest place. Branches spread over an area 108 feet in diameter. The trunk appears sound, but the branches are much decayed, and probably half of them have fallen. Two elms, at Hatfield, on the main road in the village, both in very sound and fine condition;—the first, at the ground, 25 feet; at 2 feet above, 17 feet 2; at 3 feet above, 15 feet 5, smallest part. The second, at the ground, 20 feet 7; at 2 feet above, 15 feet 5; at $3\frac{1}{2}$ feet above, 13 feet 7, smallest part.

An elm tree, nearly opposite the house of Heman Day, Esq., in West Springfield, was planted by him on the 8th of January, 1775. At the time of transplanting, it was a sapling carried in the hand. The trunk, in 1829, was 18 feet in circumference to the height of 12 feet above the surface, where it divides into branches which overhang a circle of more than 300 feet in circumference, covering 7,500 square feet of surface.—*N. E. Farmer*, VII, 299.

It had thus grown 216 inches in circumference in 54 years, or at the rate of 4 inches a year. All the circles of growth must average two thirds of an inch. In 1845, this tree was carefully measured by a gentleman of Springfield, who gives me the following dimensions:—at 3 feet, its diameter is 7 feet; at 5,

6 feet 5.7; at 8, 8 feet; at 11, 7 feet 4.7 inches. The spread of the top is 134 feet 8 inches.

The great elm, on Boston Common, measured, in 1820, 23 feet at the ground; and 20 feet at 3. In 1844, it measured, near the ground, 23 feet 6; at 3 feet, 17 feet 11; at 5 feet, 16 feet 1. On a map of Boston, published in 1720, this elm is delineated as a large tree. It is said to have been planted about the year 1670, by Capt. Daniel Henchman, an ancestor of Gov. Hancock. It is, therefore, more than 175 years old.*

The "Washington Elm," in Cambridge, so called because beneath its shade or near it, Gen. Washington is said to have first drawn his sword, on taking command of the American army, measured, in 1842, 15 feet 2, at 1 foot, and 13 feet 2, at 3 from the ground. In 1844, it measured 13 feet 2½ inches, at the same point, where the girth is smallest. The celebrated Whitefield preached under the shade of this tree, in 1744.

The following measurements and accompanying particulars are taken from a communication in the *New England Farmer*, Vol. IV, p. 242, made in 1826:—

Two elms were set out by the Indians, in front of the house of Rev. Oliver Peabody, who succeeded, in 1722, to the venerable Elliot, the Indian apostle, in the same truly Christian ministry, in Natick. This voluntary offering of the grateful savages, they called *trees of peace*. A similar offering was made to Mr. Peabody's successor, Rev. Stephen Badger. These latter trees were standing, in 1826, having been planted 73 years. They measured 15 feet at the ground, and 9 at the smallest place above, having grown half an inch in diameter annually. A tree standing in Framingham, which was 90 years old, measured, in the same year, 20 feet at 1 foot from the ground. This indicates an annual growth in diameter of more than four fifths of an inch. The same communication states, that the Charter Oak, in Hartford, Conn., measured, at the ground, 36 feet in girth, and at the smallest place above, 25 feet.

Sp. 2. THE SLIPPERY ELM. *Ulmus fulva*. Michaux.

Figured in Michaux, *Sylva*, Plate 128.

The slippery elm has a strong resemblance to the common elm. It has less of a drooping appearance, and the bark of the smaller branches is rougher, and of a lighter color; on the trunk it is somewhat smother and darker. It is commonly a much smaller tree. The leaves are thicker and rougher,—excessively rough above. The recent shoots are light gray, and very

* See an article in the *North American Review*, July, 1844, for much curious information on the longevity of trees.

rough; the older branchlets grayish, or grayish purple. The leaves are on short, stout, hairy and rough footstalks, very large, from four to seven inches long, and three or four wide; heart-shaped and very unequal-sided at base, the upper side being full and spreading back over the footstalk; the termination a long slender point; the margin coarsely and doubly, rather obtusely serrate; both surfaces very rough, the lower less so, but hairy on the veins and nerves, which are prominent, parallel, straight, and usually divided towards the edge. The upper surface is a pale green, the lower much whiter; veins irregular, reticulate; serratures less falcate than in the common elm. The surface of the latter is rough in one direction, and smooth in the other; of the slippery, rough in both. The buds are small, acute, and black. The larger branches are brownish, somewhat striate, the bark cracking and becoming ragged at an earlier age than in most trees. On the young and vigorous branches, the leaves are often eight or ten inches long, by four or five broad, and of an oblong shape. The bark is tough and mucilaginous, with abundant mucilage beneath it. The flowers are in lateral clusters, on short footstalks. The flower-cup is usually divided into seven parts, and has seven long stamens with dark purple anthers. The ovary is compressed, surmounted by two, purple, glandular styles. The seed vessel, or samara, is larger than that of the common elm, and with a broader and more entire border.

The slippery elm is rare in the eastern part of the State. I have not found it, growing naturally, nearer to Boston than Natick. In the western counties, it is more abundant. In many places I have found it dead or dying, from having been stripped of its bark. The largest tree of this kind which I have measured, was six feet ten inches in circumference, at four feet from the ground. It was found growing in Natick. Contrary to the observation of Michaux, I have found this tree growing in rich low ground, much more frequently than on higher.

The inner bark of this elm contains a great quantity of mucilage, and is a favorite popular prescription, in many parts of the country, for dysentery, and in affections of the chest.

It is much to be regretted that the slippery elm has become

so rare. The inner bark is one of the best applications known for affections of the throat and lungs. Flour prepared from the bark by drying perfectly and grinding, and mixed with milk, like arrow-root, is a wholesome and nutritious food for infants and invalids.

Dr. Darlington says that, in the last war with Great Britain, the soldiers on the Canada frontier, found this, in times of scarcity of forage, a grateful and nutritious food for their horses.

Michaux considers the wood of the slippery elm as¹ superior to that of the white. He says, "The heart is coarser-grained, and less compact than that of the white elm, and of a dull red tinge. I have remarked that the wood, even in branches of one or two inches in diameter, consists principally of perfect wood. This species is stronger, and more durable when exposed to the weather, and of a better quality than the white elm; hence, in the Western States, it is employed with greater advantage in the construction of houses, and sometimes of vessels, on the banks of the Ohio. It is the best wood of the United States for blocks, and its scarceness in the Atlantic States is the only cause of its limited consumption in the ports. It makes excellent rails, which are of long duration, and are formed with little labor, as the trunk divides itself easily and regularly: this is probably the reason that it is never employed for the naves of wheels."—*Michaux*, Vol. III, p. 90.

I find, however, that it is used for the purpose of making hubs in some places in the western part of the State, and is preferred to the white elm. It is so rare in the eastern part of the State, that I have not been able to find any one in this quarter acquainted with its properties.

Michaux found this elm in all parts of Canada and of the United States, except the maritime parts of Carolina and Georgia.

Sp. 3 THE ENGLISH ELM. COMMON EUROPEAN ELM. *Ulmus campestris*. Linn. *Introduced*.

In Boston, and some towns in the immediate vicinity, many of the finest elms are of this species. They are said to have been first imported and planted by a wheelwright, for his own

use in making hubs for wheels, for which purpose they are probably superior to any other wood known. They have come, however, to be far too valuable, as trees of ornament, to be often cut down for use. The English elm is a noble tree. If it has less grace than the American, it has more stateliness and grandeur. It has more of the strength of the oak. It is distinguished from the American elm by its bark, which is darker and much more broken; by having one principal stem which soars upwards to a great height, and by its branches, which are thrown out more boldly and abruptly, and at a larger angle. Its limbs stretch out horizontally, or tend upwards, with an appearance of strength to the very extremity. In the American, they are almost universally drooping at the end. Its leaves are closer, smaller, more numerous, and of a darker color. It has been objected to this elm by Gilpin, (*Forest Scenery*, I, p. 90,) that it wants a definite character, that it has often so great a resemblance to an oak that it may, at a distance, be mistaken for it. The observation is undoubtedly well founded, but to one who would gladly have the satisfaction of looking on the king of trees, but cannot wait for its tardy growth, it is very far from an objection. The American elm is so planted every where, that it is possible to be weary of seeing it; in which case, as a variety, the sight of a stately English elm is a relief. It has, moreover, the advantage of being clothed in an unchanged foliage, *several weeks* longer than our native tree.

The English elm continues to increase for one hundred, or one hundred and fifty years, and probably much longer, although, compared with the oak, it is not a long-lived tree, the very old ones being usually hollow at the base. For several centuries it has been planted for ornament, on avenues and public walks in France, Spain and the Low Countries, and in England, immemorially. When full grown, it is four or five feet in diameter, and sixty or seventy feet high. Raised from seed, it forms innumerable varieties, distinguished by their difference in habit and appearance, time of leaf and peculiarity of hue, and by the qualities of the wood. These varieties, some of them very valuable, are propagated by shoots, and by grafting. Like the American elm, it is of very rapid growth.

Evelyn says it has been known to rise to the height of a hundred feet in less than a century.

Many large elms are described by Loudon and Strutt, and several of the most remarkable in England are figured by the latter in his *Sylva Britannica*. The finest of these, the Chipstead Elm, "is sixty feet high, twenty feet in circumference at the base, and fifteen feet eight inches at three feet and a half from the ground. It contains 268 feet of timber. Its venerable trunk is richly mantled with ivy, and gives signs of considerable age; but the luxuriance of its foliage attests its vigor, and it is as fine a specimen of its species in full beauty as can be found."—*Sylva Britannica*, p. 60.

"The Crawley Elm stands in the village of Crawley, on the high road from London to Brighton. It is a well known object to all who are in the habit of travelling that way, and arrests the eye of the stranger at once by its tall and straight stem, which ascends to the height of seventy feet, and by the fantastic ruggedness of its wildly spreading roots. Its trunk is perforated to the very top, measuring sixty-one feet in circumference at the ground, and thirty-five feet round the inside at two feet from the base." (Ib. p. 62.) This tree is not so large as would seem from this account, as it diminishes very rapidly upwards.

There are many fine trees of this kind in Boston, Roxbury, Dorchester, and some other neighboring towns, but none of very great size.

The largest on the Mall, bordering Boston Common, was measured by Prof. Gray and myself in 1844, and found to be twelve feet and three inches in circumference at three feet from the lower side, and eleven feet two inches at five feet. It is a stately and very beautiful tree. The European elms on Paddock's Mall, near Park Street Church, are said to have been planted in 1762, by Major Adino Paddock and Mr. John Ballard. In 1826, several of them measured nine feet at four from the ground, having grown more than one and a half inches a year. Several of them now measure nine feet ten inches at four feet, having grown only half an inch annually, for the last twenty years. This, however, is not surprising, as they are immediately surrounded on all sides by an almost impenetrable pave-

ment, and must get all their nutriment from a distance on one side, beyond a heavy wall. A differently constructed gutter, allowing the water and drainings of the street to penetrate, would doubtless quicken their growth.

The noblest and most beautiful English elms in this vicinity are found on the grounds of the country residence of Henry Codman, Esq., in Roxbury. The largest stands by the principal gate in front. At three feet from the ground, it measures seventeen feet and five inches; at five feet, fifteen feet ten inches. It has lost several of its lower limbs, and with them much of its beauty; but it holds its size fully to the height of twenty or twenty-five feet, where it divides into three large branches, the main, central one of which, rises upwards to a height much above one hundred feet, perhaps to one hundred and twenty or one hundred and twenty-five. Another, standing on the lawn, within the enclosure, has nearly the same elevation, with a girth of twelve feet eight inches at three feet, and eleven feet seven at five. Several trees of the same kind in the rear of the house are known to have been planted in 1796, so that they have now been planted nearly fifty years. The largest and most northerly of these measures eight feet eleven inches at three feet from the ground. Two others, being the most westerly ones, have each a girth of seven feet ten inches at three feet. The largest of these has thus made an annual growth of more than two inches annually, and the others but little less. All these trees are favorably situated, in the midst of highly cultivated grounds, and the last mentioned grow in a moist situation near a never failing stream.

The uses of this tree in England and on the continent of Europe, are very numerous. Its wood is of a brownish color, and is hard and fine grained, and of great lateral adhesion, and it is little liable to crack or split when exposed to sun or weather. It is therefore much employed for ship's blocks, and other wooden parts of the rigging. It is also remarkable for its durability in water. It is employed for the keels of large ships, and for pumps, water-pipes and troughs; for mills and water-wheels, piles, ship-planks beneath the water line; also for gates and rails, the knotty for hubs of wheels, the straight and smooth

for axle-trees, and for innumerable other purposes. A variety called the Twisted Elm, *Orme tortillard*, is very highly valued in France for its extreme toughness, and also for the beauty of its grain. When frequently pruned, the wood of the elm becomes knotted, and is prized by cabinet-makers in France. It takes a fine polish, is very ornamental, and, when stained, extremely beautiful. The knobs which grow on old trees are remarkable for the curious interlacing and twisting of fibres, and as veneers, are used, like mahogany, for articles of furniture.

As among the ancient Romans, so in France at the present day, the leaves and shoots are used to feed cattle. In Russia, the leaves of a variety are used as a substitute for tea. The inner bark is in some places made into mats, and in Norway, they kiln-dry it, and grind it with corn as an ingredient in bread.

The European elm “produces abundance of suckers from the roots, both near and at a great distance from the stem; and throughout Europe these afford the most ready mode of propagation, and that which appears to have been most generally adopted, till the establishment of regular commercial nurseries. On the Continent, plants are very often procured from stools, simply by heaping up earth about the shoots which proceed from them. These shoots root into the earth; and, after growing three or four years, during which time they attain the height of ten-feet or fifteen feet, they are slipped off; and either planted where they are finally to remain, or in nursery lines. When they are transplanted to their final situation, the side shoots are cut off; and the main stem is headed down to the height of eight feet or ten feet; so that newly planted trees appear nothing more than naked truncheons. The first year, a great many shoots are produced from the upper extremity of each truncheon; and in the autumn of that year, or in the second spring, these shoots are all cut off but one, which soon forms an erect stem, and as regular a headed tree as if no decapitation had previously taken place. All the avenues and rows of elm trees in Europe were planted in this manner previously to about the middle of the eighteenth century; and, according to Poiteau,

the same practice is still the most general in France.”—*Lou-don's Arboretum*, Vol. III, p. 1383.

In England, trees are planted without being headed down, but on the Continent, from the greater warmth of the summers, they are apt to be killed, when transplanted with their branches, in consequence of the great evaporation from their leaves. Our summers are even hotter than those of the Continent of Europe, and the practice which has been so long found perfectly successful there, will be likely to be better suited to our climate than the English mode.

A practice recommended by Evelyn, (*Discourse*, p. 127,) is still in use abroad, and may, in some cases, be very convenient. When, as is often the case in this country, no suckers spring up round the tree, “bare some of the master-roots of a vigorous tree within a foot of the trunk, or thereabouts, and with your axe make several chops, putting a small stone into every cleft, to hinder the closure, and give access to the wet; then cover them with three or four inches of earth, and thus they will send forth suckers in abundance; I assure you, one single elm, thus well ordered, is a fair nursery, which, after two or three years, you may separate and plant in the *ulmarium*, or place designed for them; and which, if it be in plumps, as they call them, within ten or twelve feet of each other, or in hedge-rows, it will be better; for the elm is a tree of consort, sociable, and so affecting to grow in company, that the very best which I have ever seen, do almost touch one another: this also protects them from the winds, and causes them to shoot of an extraordinary height, so as, in little more than forty years, they arrive to a load of timber, provided they be sedulously and carefully cultivated, and the soil propitious; for an elm does not thrive so well in the forest, as where it may enjoy scope for the roots to dilate and spread at the sides, as in hedge-rows and avenues, where they have the air likewise free.”

I have been thus particular in regard to the English Elm, because of its great beauty and rapid growth, and the value of its timber, in which last particulars it is doubtless superior to the American Elm, as, in the others, it is little if at all inferior.

Sp. 4. THE SCOTCH ELM. *Ulmus montana*. Bauhin.

Another elm which has been partially introduced in this country, and is very much cultivated in Scotland, and the northern parts of England, is the Scotch Elm, otherwise called the Wych Elm, or Wych Hazel. For many purposes, its wood is preferred to that of the English Elm, as it splits more freely. On the whole, however, it is inferior. It resembles our Slippery Elm.

There are several other species of elm known in this country, though I have never found them in Massachusetts. The River Elm, *U. nemoralis*, is said by Pursh, (N. A. Flora, p. 200,) to occur, rarely, on the banks of rivers from New England to Virginia. He speaks of having seen it growing. It is characterized as having oblong, smoothish leaves, equally serrate, and nearly equal at base, with sessile flowers. Michaux mentions an elm which he saw in Maine, and on the Champlain, differing from those which have been described, but which more nearly resembled the common elm.

There is described and figured in Silliman's Journal, (XIX, p. 170,) by David Thomas, a new species of elm which he calls Racemed Elm, *U. racemosa*, whose specific character he gives thus:—

“*ULMUS RACEMOSA*.—Flowers in racemes; pedicels in distinct fascicles; united at their bases. A tree. Lower branches, with irregular corky excrescences. Leaves, ovate, acuminate; auriculate on one side; doubly serrate; above, glabrous; under side and ribs, minutely pubescent. Racemes, of several fascicles, (often three or four, with a terminal flower;) one to two and a half inches long—from the sides of the last year's branches, and often garnished with small but perfect leaves, before the terminal buds open. Fascicles of from two to four flowers. Flowers, pedicellate. Calyx, from seven to eight-cleft. Stamens, from seven to ten. Stigmas two, recurved. Samara, ovate, pubescent; membrane more extended on one side; margin densely fringed. A native of Cayuga

County, in the state of New York, and of the adjacent country.”
Silliman's Journal, Vol. XIX, p. 170.

It is possible that this elm, which has some affinity with the Cork Elm of Europe, though evidently a distinct tree, may be found in the western part of this State. I have seen some small trees resembling it in the corky bark, while in other respects they were like the common elm.

X. 2. THE NETTLE TREE. *CELTIS*. L.

This genus contains handsome trees, or tall shrubs, natives of North and South America, Asia, and Europe, with alternate, deciduous, unequal-sided, strongly nerved leaves, axillary flowers, with five stamens, and a calyx of five divisions; and small, sweet, wholesome stone fruit. The nettle trees are of a strikingly elegant appearance, from the breadth of their ample and richly tufted head. They grow well on the poorest and most arid soils, but flourish best in a soil which is rich and moist. In such situations, their growth is very rapid. The wood of some of the species is remarkable for its hardness and tenacity; of others, too soft to be of much use. Their foliage is rich and abundant, of long continuance, and not liable to the attacks of insects, and is remarkable for falling almost at once. The flowers come out early, before the leaves; and the fruit, which ripens in Autumn, remains on the tree till the following Spring. The name *nettle tree* has been given from the resemblance of the leaves to those of some species of nettle. There are about twenty species, four of which are found in North America. Several of these trees are very ornamental, and none more so than the two found in Massachusetts.

Sp. 1. THE AMERICAN NETTLE TREE. *C. occidentalis*. L.

Figured in Michaux, Sylva, III, Plate 114, and in this volume, Plate 16. The tree is well represented in Loudon, Arboretum, VII, Plates 192 and 193.

This fine tree has a strong resemblance to an elm, and is often, by careless observers, mistaken for one. Its branches have something of the drooping character of those of the common elm, but much less than they, and are more inclined to

spread horizontally. The trunk is covered with a grayish and rough bark. It seldom extends to a considerable height, without throwing out numerous, slender branches. The ultimate branchlets are extremely slender, downy when young, and covered with a reddish brown bark. The leaves, commonly from one and a half to three inches long, and from one to two broad, vary much on the fruit-bearing and on the vigorously growing limbs. On the latter, they are large, rather thick, broad and conspicuously serrate; on the former, they are smaller and more delicately shaped, more sharply serrate, and have a much longer acumination. On both, they are downy when young, and rough on both surfaces, but afterwards become nearly smooth. They are ovate in their general outline, acute, rounded, or obtuse, and sometimes slightly heart-shaped at base, commonly unequal-sided, but sometimes equal-sided; very irregularly dentate or serrate about the middle, and end in a long, taper, entire point. They are borne on slender footstalks, which continue slightly hairy till late in the season. The leaves are of a dark green, which turns to a bright yellow in autumn, when they fall nearly all together.

The flowers come out very early, on long footstalks, from one to three in the axils of the leaves. They have a calyx of five, or sometimes six divisions, with five or six stamens. The lower flowers have usually stamens only, and are barren; the upper, solitary flowers have also an ovary which becomes a fruit. This is sweet to the taste, about the size of a wild cherry, has a large stone, and, when perfectly ripe, is of a dark purple color. The tree might be described to one who wished to be able to recognize it, as an elm, bearing purple, sweet cherries, which continued on the stem through the winter.

Douglas says that this tree is found on the rocky banks of the Columbia River in places so dry that no other tree can grow there. Michaux had never observed it northward of the Connecticut River. I have found it, never in great numbers, in almost every county in the State. It was pointed out to me at Savin Hill, by Dr. Bigelow, and in Dorchester by Dr. Harris. It is almost every where so rare, that its name is unknown, and it might well be called, as it was by the French in Illinois, *Bois*

inconnu, unknown wood. In Bristol County, where it is often found, and whence a fine specimen of the wood was sent me by an attentive observer of nature, Micah Ruggles, Esq., of Fall River, it is called False Elm, from its strong resemblance. In Middlesex, it is so rare that a friend, whose eye is open to whatever is curious in nature, and who showed me specimens of its leaves, had been unable to find any name for it among the common people, his neighbors. It is, throughout the State, a small tree, seldom rising above forty or fifty feet in height, and twenty or twenty-four inches in diameter.

It is said by Torrey, who gives it the name of *beaver wood* and *hoop ash*, to be found particularly in rocky situations, on the banks of rivers. Specimens of the leaves and wood have been sent me from the banks of the Potomac, under the names of *sweet gum* and *sugar berry*. Elliot says that along the margin of salt water, in the sea islands of Carolina, where it grows in light, rich soils, it sometimes attains the height of sixty or eighty feet, and a diameter of three or four. Michaux had found it in greatest vigor on the Savannah, where, in a cool and shady situation, he had seen trees sixty or seventy feet high, and eighteen or twenty inches in diameter.

This is so rare a tree, that I have not been able to find that any one is acquainted with the qualities of its wood. Michaux supposed, from its similarity to the European nettle tree, that it must have the same properties. That tree, *C. Australis*, is supposed to have been the Lotus of the ancients, the sweet fruit of which was the food of the *lotóphagi*, and which Homer describes as so delicious, that those who ate thereof, straightway forgot their native country, or lost all desire to return home.

The European is a small tree, seldom fifty feet high or three in circumference. Its wood is extremely compact, taking a place between that of the live oak and the box for density and hardness. It weighs, when dry, according to Baudrillart, 70 lbs. 3 oz. per cubic foot. It is susceptible of a high polish, and, when cut obliquely across the fibres, resembles satin wood. It is used for making furniture, and by carvers for images of the saints. The branches are very supple, tough, and elastic, and are much

used, in the south of France, for making hay-forks. In that country, plantations of it, for that purpose, are common. In the department of Gard, seven acres of rocky land, unfit for any other use, planted with nettle trees, yield, annually, five thousand dozen of hay-forks, giving a revenue of five thousand dollars yearly. When cut close to the ground, the stem sends up numerous vigorous shoots, of great flexibility. Planted close, in masses, they rise to considerable height, without much thickness, furnishing admirable handles for coach-whips, ramrods for muskets, and walking-sticks. And so highly are they valued that, according to Baudrillart, all the coachmen in Europe are supplied from plantations on rich soil in Narbonne, which are made expressly for this purpose. It is also used for the shafts and axletrees of carriages, the naves of wheels, and for musical instruments. The root is used for dyeing yellow; the bark for tanning; and an oil is expressed from the stones of the fruit.—*Loudon's Arb.*, 1415.

Sp. 2. THE HACK BERRY. *C. cràssifolia*.

Leaves and fruit represented (incorrectly) in Michaux, Sylva, III, Plate 115.

Michaux assigned the banks of the Delaware as the north-eastern limit of the hack berry. I find, however, that it grows in Massachusetts, on the banks of the Connecticut. Specimens of the leaves, which I had gathered as those of the nettle tree, turn out, on careful examination, to belong to this tree. I have found it in only two places:—in Springfield, on the east side of the Connecticut River, and in West Springfield, on the west. Some of the trees are, I hope, still standing. The most remarkable one has been destroyed. It grew a few rods north of the Hampden House, in the broad county road, in Springfield. When I measured it, in September, 1838, its girth, at three feet from the ground, was sixteen feet ten inches; at four, it was fourteen feet three inches; at six, thirteen feet. It had gnarled, projecting roots, putting out on every side till nearly three feet from the surface. It diminished, gradually, to the height of twelve or fifteen feet, and there had several broad, irregular protuberances, where it had lost large limbs. Above this it tapered

rapidly, dividing into three branches, which formed a small, round, rather dense top, fifty or sixty feet high. It was covered with a very rough, brownish gray bark, and had, altogether, so much the aspect of an elm, that it was, almost universally, taken for one. I was informed that a still larger tree of the same kind had formerly grown near it. Within two years, this noble tree has fallen, like its brother, before the axe of *improvement*. The leaf-bearing branchlets are very slender, slightly downy, and covered with a reddish brown bark. The buds are small, compressed, and rather pointed. The leaves are four or five inches long and less than two wide, borne on a small, round, short, somewhat hairy stalk. They are unequal-sided, the side next the branch being much broader than the other and strongly half-heart-shaped; the other side being sometimes, but not always, half-hearted; they are oblong, tapering very slowly, ending in a long acumination, and sharply serrate almost to the very point; rough on both surfaces, bright green above, pale beneath. They are less thick than the leaves of the nettle tree; although, in other respects, they correspond sufficiently well with the description and figure of Michaux.* To him and to other writers, I am indebted for the remainder of this description; for I have not seen the flowers, fruit or wood.

The trunk is commonly straight and without branches to a great height. The bark is grayish and broken, thickly and irregularly set with hard, blackish, permanent, corky asperities. The branches are nearly horizontal and slender. The branchlets inclined or pendent, small, close-set, brown, scattered with small, whitish warts; the young ones green, more or less downy. The leaves on the vigorous shoots are from four to seven inches long, and often of equal breadth, deeply toothed and rough, sometimes almost equal-sided, sometimes exactly heart-shaped, sometimes half-heart-shaped, or ovate-lanceolate. The stipules are linear-lanceolate and pointed. Flowers of the size of those of the nettle tree, with the segments of the perianth oblong, obtuse, fringed at tip, ciliate on the border. Ovary conical, sur-

* Spach, who is familiar with the tree as cultivated in France, finds fault with this figure, because the fruits are incorrectly represented as black, and as growing upon a stout and vigorous shoot with large and thick leaves.

mounted with stigmas twice its own length. Fruit-stalks half an inch long. Drupe of the size of a large pea, and of a brownish red.—*Spach*, XI, 431.

Michaux says, "This is one of the finest trees that compose the dusky forests on the upper part of the Ohio. It associates with the buttonwood, black walnut, butternut, bass wood, black sugar maple, elm and sweet locust, which it equals in stature but not in bulk, being sometimes more than eighty feet high, with a disproportionate diameter of eighteen or twenty inches.

"The wood is fine-grained and compact, but not heavy, and when freshly exposed it is perfectly white: sawn in a direction parallel or oblique to its concentrical circles, it exhibits the fine undulations that are observed in the elm and the locust. On laying open the sap of this tree in the spring, I have remarked, without being able to account for the phenomenon, that it changes in a few minutes from pure white to green. On the Ohio and in Kentucky, where the best opportunity is afforded of appreciating this wood, it is little esteemed, on account of its weakness and its speedy decay when exposed to the weather. It is rejected by wheelwrights, but is sometimes employed in building, for the covering which supports the shingles. As it is elastic and easily divided, it is used for the bottom of common chairs, and by the Indians for baskets. On the banks of the Ohio, it is frequently taken for the rails of rural fence, and is wrought with the greatest ease, as it is straight-grained and free from knots: it is said, also, to afford excellent charcoal.

"The hack berry is certainly one of the most beautiful trees of its genus, and one of the most remarkable for height and for majesty of form. In rich soils, the luxuriance of its vegetation is shown by sprouts, six, eight, and ten feet in length, garnished on each side with large, substantial leaves. In France, it is principally esteemed for the rapidity of its growth."—*Sylva*, III, 47—48.

Spach says it grows readily on all kinds of soil, and is remarkable for its beauty and for the rapidity of its growth.

There are two trees of this family of such value for their wood, and of such beauty, that they ought not to be passed

without notice. The one is the Planer tree, *Plánera úlmifolia*, of Michaux, which is found on the banks of the Mississippi, and in Kentucky and Tennessee. The other is the Zelkova or Tselkwa, *Plánera Richardi*, of Michaux, a native of the country between the Black and Caspian Seas, from lat. 35° to 47°. This was introduced into France in 1782, by the elder Michaux, and has since been cultivated both in that country and England. Its trunk resembles that of a beech, being kept smooth by the exfoliation of the outer bark. It is a lofty, richly tufted and picturesque tree, remarkable for its rapid growth, and for its shining green leaves being not liable to the attacks of insects. Its wood is of very great value, extremely beautiful, heavy, dense and hard, finely-veined and susceptible of the highest polish, and surpassing oak in durability, never becoming worm-eaten, however old it may be.

There is another tree, belonging to the family of *Balsamaceæ*, for which I have hitherto searched New England in vain, which yet is probably found here; as it occurs abundantly in parts of New York nearest us. It is the Sweet Gum, *Liquidámbar styraciflua*, whose star-like leaves are so conspicuously beautiful in the woods of New Jersey in autumn.

FAMILY XI. THE SANDAL WOOD FAMILY. *SANTALACEÆ*.

R. BROWN.

This family, which receives its name from the Santalum, one species of which produces the well-known odoriferous sandalwood, comprehends trees, shrubs, under-shrubs and herbs. The flower-cup is three- or five-cleft, greenish and leaf-like externally, and colored internally. A fleshy disk which is entire or lobed, occupies the bottom of the flower, and adheres to the base of the flower-cup, or to the ovary. The stamens are equal in number to the lobes of the flower-cup, or twice as many. The ovary is one-celled, with from one to four ovules. The fruit is a drupe or nut, one-celled and one-seeded. The leaves are alternate, and undivided. In North America, it includes trees,

as well as some small herbaceous plants; in New Holland, the East Indies, and the South Sea Islands, trees and shrubs; in Europe, only in conspicuous weeds.

One genus of the trees of Massachusetts belongs to it, THE TUPELO, *Nyssa*. L. This is placed by some writers,* in the Linnæan class Diœcia, order Pentandria; by others,† in Pentandria, Monogynia; by Linnæus himself and others,‡ in his class Polygamia.

On different trees three kinds of flowers are found, some containing only stamens, others stamens and a pistil; others only a pistil. None have a proper corolla. In the staminate flowers, the calyx is five-parted; the stamens from five to ten or twelve, inserted around a glandlike disk. In the pistillate flowers, the calyx is five-cleft; stamens five or none; the style simple, often revolute; succeeded by a one-seeded, somewhat fleshy drupe, containing an ovate, striate nut.

This genus is confined to North America. The trees grow by streams or stagnant waters. They have alternate leaves, entire, or with large angular teeth, and are smooth, reticulate or downy beneath; and flowers springing from the axil of the leaves, the male in racemes or heads, the fertile solitary, or with two or three on a stem.

Of the trees of this kind found in this State, varying exceedingly in their shape, and especially in their leaves, I have had great hesitation, whether to consider them as belonging to two or three species, or only as varieties of one. I am rather inclined to the latter conclusion, and that they belong to the species which has been called

THE TUPELO TREE. *Nyssa multiflora*. Walter.

In Bristol County, and the other south-eastern counties, this is called the Snag Tree, and sometimes Horn Pine. In the western parts of the State, it is called Pepperidge; and often, in every part, it is called Hornbeam, from the extreme toughness of the wood. It is nowhere called Gum Tree, by which name it is commonly known in the Middle and Southern States. The

* Nuttall, Elliott.

† Darlington.

‡ Bigelow.

most suitable name, and one not appropriated to any other tree, is *Tupelo*, the name by which it and several other species of this genus were known to some tribes of the aborigines.

The *Tupelo* is always a striking, and often a very beautiful tree. It usually rises to a height of not more than thirty or forty feet; but in dense, moist woods, where it has been surrounded by other tall trees, I have seen it sixty or seventy feet high. No tree varies more in its aspect. In the neighborhood of Boston, where it abounds, especially in the low grounds in Cambridge, on the borders of Jamaica Pond, and in other places in Brookline, it is a low tree, throwing out a very great number of horizontal or drooping branches, forming a short, cylindrical head, flat above. Where it has long stood by itself, and its natural tendency has been completely unimpeded, it forms a low, very broad, palm-like head. Sometimes it is pyramidal or conical; and sometimes the dense mass of foliage has the shape of an inverted cone, very broad and flat at top.

The trunk, which is almost always erect, and which seldom rises many feet,—commonly not more than six or seven,—before it throws out branches,—is invested with a dark ashy gray bark, much, but not deeply broken by longitudinal furrows. In very old stocks it is sometimes broken into somewhat regular polygons. The branches, which are far more numerous than on any other tree, frequently so close to each other, that it would be difficult to find room for more, are almost uniformly horizontal near the trunk, and arch downwards towards the extremities. Often very crooked, they are thickly set with smaller ramifications, which form a short spray, projecting in every direction. The bark on the new shoots is of a bright apple or reddish green, on the older branchlets it is red or brownish, shining through a pearly, thin epidermis. The leaves, which are alternate on the growing shoots, but in tufts of four or more on the ends of the lateral branchlets, are of a resplendent green above, reflecting the light like those of a tropical plant. They are somewhat paler beneath, and vary in shape from lanceolate to broad oval, and obovate, and in size from one inch to four or five inches in length, and from one half an inch to two inches in breadth. They are usually wedge-shaped at base, sometimes

taper to a long point, sometimes are obtuse, and even emarginate or slightly notched, at the extremity. Generally, they are entire at the edge, but I am acquainted with some trees which constantly bear leaves of a very large size, and notched with several large teeth towards the extremity. The surface is sometimes perfectly smooth above and below, most frequently hairy or downy beneath, especially when young. The texture is rather firm and coriaceous. They are borne on short, roundish petioles, flat above, green, or of a rich scarlet or crimson color, when exposed to light; and to some shade of these colors, the whole leaf turns in early autumn. The petiole often has an expansion or margin on each side, and is invested with ciliate rows of hairs, which usually fall off as the leaf grows old. The sterile flowers sometimes form little umbels or heads of from four to eight greenish flowers on the end of a downy footstalk of a uniform size, and an inch or less in length—sometimes the footstalk terminates in an open cluster of from two to five or six flowers, which are very small, and of a yellowish green, and rest on very short stalks. The flower consists of from four to eight, oblong, or ovate, pointed, obtuse, or emarginate, green sepals, with from four to eight stamens rising from beneath or from the edge of a glaucous, fleshy disk.

The fertile flowers form a close whorl of three or more very small flowers, sometimes but two or one, on the end of a short club-shaped footstalk, which lengthens as the fruit advances, till it becomes one or two inches long. The fruit, of which seldom more than one or two, on the same footstalk, come to perfection, is an oblong or elliptic drupe, of a deep blue-black, when mature, consisting of a little acid flesh, enveloping a very hard stone, longitudinally striated.

Very little use is made of the wood of this tree. From the crossing and intertwining of its fibres, it is excessively difficult to split, and therefore, when employed as fuel, it is reserved for logs and back-sticks. In the Middle States, it is used to form the naves of wheels. But, for this purpose, it is less suitable than the elm, as it is said to be more liable to decay when exposed to the weather. It has been sometimes turned into bowls and other wooden vessels, for which its toughness renders it pecu-

liarily fit. It is better fitted than any other tree to be made into the pipes of aqueducts, as it requires no hoops; and it has been extensively employed for this purpose in the salt works at Syracuse and the neighboring towns, in New York. It is of a yellowish color when freshly cut.

As an ornamental tree the Tupelo deserves more attention than it has received. The brilliant color of the green of the leaves, and the rich scarlet and crimson to which they turn in autumn, at which season some of the trees are covered with the bright blue fruit, make it always a beautiful object.

I have been often struck with the appearance of extreme vigor and healthfulness in the young trees—and some of the old ones are amongst the noblest in the State.

There is a tree of this kind at Cohasset, which was first pointed out to me by the Rev. Dr. Greenwood, a man of taste, who was a lover of trees, and which we rode twenty-five miles expressly to see. It is richly worth a much longer journey. It stands in a lone pasture, half a mile or more eastward from a place called the Gulf. At the surface, just above the roots, it is eleven feet in circumference, and it is nine feet and two inches, up to the larger branches, which begin at about seven feet from the ground. The trunk loses little of its diameter for near twenty feet, although in that space, twenty large branches, and many small ones put out. These are very large, and project horizontally on every side, to a great distance, with an air of mighty strength and power of resistance. The bark is cleft into long prismatic ridges, nearly two inches high, which, on the larger branches, are broken into hexagons, with an approach to geometric regularity. It is of a mouse color, or purplish ashy gray, with white clouds of pertusaria, and greenish and bluish ash parmelias. The height is forty or fifty feet. The average breadth of the head sixty-three feet, its extreme breadth sixty-six. The whole head is of a broad, irregularly hemispherical shape, flat at top. A striking circumstance in this tree is the fact that the enormous horizontal branches push out as boldly seaward as in any other direction, though the north-east wind sweeps from the Bay in this quarter with a violence which has bent almost every other tree towards the land. I have ob-

served many other instances of the vigor with which the tupelo stands out against the sea breeze.

Another fine tree of the same kind is near by, rising to seventy or eighty feet in height, without large branches till towards the top.

Farther landward is a noble tree, sixty feet high, with a large flat top. This, at two feet from the surface, is six feet two inches in circumference; and, at from four to eight or nine feet, five feet eight inches. Its branches are small and nearly erect, a few large ones coming out at twenty or twenty-five feet from the ground. It is a remarkable thing to see trees of the same species growing near each other, so entirely unlike in aspect and habit as these.

Three or four other species of *Nyssa* are found in the United States, and, where well known, are considered by botanists as distinct. Those who are acquainted with these, will have recognized, in the above description, which is taken from nature, peculiarities of some of the other species. An attentive study of the protean forms of the oak, has led me to doubt the value of distinctions of nearly allied species, founded on any thing but the fruit. Till I shall have had better opportunities of examining the fruit of the several varieties of *Nyssa*, I shall not be able to say, confidently, whether there is only one, or whether there are several species in the State.

The tupelo is found around the ponds in Plymouth County, about Buzzard's Bay, in the swamps in Franklin, and the other river counties, and in other parts of the State. It is found near Portsmouth, N. H., and in the Middle and Southern States, as far as Carolina and Georgia.

FAMILY XII. THE CINNAMON FAMILY. *LAURINEÆ*.

VENTENAT.

Most of the plants of this family are trees of great beauty, and often of a lofty stature. It also contains shrubs and a few leafless, parasitic, climbing herbs. Only eleven or twelve spe-

cies were known to Linnæus, all belonging to the genus *Laurus*, but the family now contains more than four hundred species, divided into more than thirty genera, of which the greater part are natives of regions between the tropics; some few are found in the northern temperate zone; and Massachusetts is, in this country, very nearly their northern limit. All are remarkable for their warm, stimulating, aromatic properties, owing, usually, to essential oils, which abound in their bark and leaves. Several species, in different eastern lands, yield the different sorts of cinnamon and cassia, the genuine being the produce of varieties of the *Cinnamomum zeylanicum*. Camphor is extracted from the roots of the *Cámphora officinárum*, by boiling. It is also found, in ample or minute proportion, in the wood of the trunk or root of many other species. The delicious Avocado pear, the aguacate of the Spaniards, often called by the English the Alligator pear, and said to be worth a voyage from Europe to the West Indies to taste, is produced by a tree of this family, the *Pérsea gratissima*. The wood of many of the species, found in southeastern Asia, retains the pleasant camphorette odor many years, and is sought for as the material for the finishing and furniture of oriental dwellings; as in beauty, hardness and durability, it sometimes vies with mahogany. The *sweet-wood* timber of Jamaica, and many valuable woods of South America are produced by trees of this family. The botanical name is derived from the only plant of the family indigenous to Europe, the bay tree, *Laúrus nóbilis*, the laurel of the ancients, the emblem of victory and of clemency, and sacred to their god Apollo. Victorious generals were crowned with a wreath of bay leaves, an honor which, in later times, has been transferred to distinguished poets, thence called poets laureate. The name of baccalaureate degree, that of bachelor of arts, seems to have had a similar origin from *bacca laurea*, the laurel berry.

The leaves are mostly entire, and usually coriaceous, smooth and shining. The flower-cup is of one piece, with four or six divisions arranged in two rows, and with a fleshy disk occupying its centre. The flowers are sometimes perfect; sometimes fertile and sterile flowers are on different plants, or on the same.

The stamens are as numerous as the divisions of the flower-cup, and opposite them, or two, three, four, five or six times as numerous. When there are more than three rows, the inner ones are sterile. The anthers open by valves, which curve upwards. The fruit is a one-seeded berry or a drupe, usually supported by a thickened, club-shaped stalk.

The only genera found in this State, are the Sassafras and the Spice Bush or Fever Bush, *Benzoin*; the former a tree, the latter a shrub. Both have six-parted yellowish flowers with nine stamens, which are all fertile in the male flowers; the female, six sterile ones.

The Sassafras has its anthers opening with four valves, and its fruit borne on a stem thickened and fleshy at the extremity. The Spice Bush has anthers with only two valves, and its fruit-stalk not fleshy at the extremity.

XII. 1. THE SASSAFRAS TREE. *SA'SSAFRAS OFFICINALE*. Nees Von Esenbeck.

Figured in Audubon's Birds, II, Plate 144; in Michaux, Sylva, Plate 81; Bigelow's Medical Botany, II, Plate 35.

The sassafras, in this State, rarely reaches thirty feet in height and a foot in diameter. I have, however, measured some which were forty or fifty feet high and nearly two feet in diameter. The old tree is a striking but not a beautiful object, at least when the trunk is visible, which is rarely erect, but usually bending upwards, and sometimes crooked. The bark, on old stems, is of a reddish ash color, deeply and irregularly cracked, with the sides of the furrows striated with black and gray lines, showing the annual layers. The color of the interior of the bark is dark red, like some kinds of cinnamon. The branches are numerous, bare and crooked. The young tree is often beautiful, from the rich color of the luxuriant foliage and the recent shoots; and on young and old trees, the head is broad, round and finely tufted. The living bark is commonly free from most kinds of lichens, but an occasional dead branch will be found covered with *Lecanoras* and *Lecideas*, and patches of common and golden-eyed *Parmelias*. On young trees, the

bark is a reddish green, striated with ash; the branches are in imperfect whorls, and stand nearly at right angles to the trunk, curving slightly from branchlet to branchlet. On old trees, the appearance of regular whorls in the branches is lost, from the smaller ones being outstripped by the larger, and some of them dying; and the graceful curvature is lost, and the branches are bare and crooked. The spray is long and irregular, forming a sharp angle with the small branches, and curving upwards. It is of a yellowish green color and downy surface. The terminal buds are large, ovate, and invested at base with three or four scales of the color of the twig.

The leaves of the same tree are remarkable for their variety of form. They are supported on petioles of one quarter or one fifth the length of the leaf, are acute or wedge-shaped at base, often entire, sometimes oval with an imperfect lateral lobe, more frequently, especially towards the ends of the branches, dilated and three-lobed. They are of a pleasant green; in the autumn becoming a delicate buff, leather yellow or orange. The scales of the buds, which are covered with down, on expanding, remain to protect the branch of leaves and flowers which they enclosed, and which are alike clothed with a hairy or silken down. This disappears from the upper surface of the leaves as they advance in age. The under surface is marked by prominent veins. The flowers are on pendulous or nodding, slender, clustered racemes, in the axil of the bud-scales, below the leaves, around the base of the recent shoots. Each partial flower stalk has, at its base, a slender, thread-like, villose bract, as long as the foot-stalk. In the sterile flowers, the calyx usually has six yellowish, oblong, petal-like pieces, united at base to form a cup, inside of which and opposite them are six stamens, forming one circle, and inside them and opposite the alternate ones, a circle of three stamens, on each side of each one of which is an orange-colored gland on a short stalk. The anthers are short, having two cells opening inward, and, above, two smaller cells opening obliquely upwards. The style, swelling at base, stands freely in the centre, but with no ovule within.

The fertile flowers have only six short, imperfect stamens, in a single series. Ovary roundish, stigma on a short style. The

fruit is an oblong oval drupe of a dark blue, when ripe, supported by a dark red, thickened, club-shaped footstalk. They are eagerly sought after by birds, and therefore soon disappear. When perfectly ripe, and before they have begun to be preyed upon, they form a beautiful contrast with the agreeable green of the leaves.

Few of the insects which frequent the sassafras trees have been attentively studied. Caterpillars of the rabbit tussock-moth, *Lagoa opercularis* of Dr. Harris, are often found feeding on their leaves, as are those of the *Saturnia Io*; and within the leaves, the caterpillar of the *Attacus Promethea* butterfly spins its cocoon and spends the winter.—(*Harris's Report*, pp. 265, 281 and 283.) The leaves, also, sometimes furnish nourishment to caterpillars of the *Attacus luna* butterfly.—(*Drury*, I, 45.)

The wood, in young trees, is white, but becomes reddish on growing old. It is very brittle, and branches of some size may be broken with little effort, and yet the seasoned wood combines lightness and toughness in a higher degree, than almost any other wood, and is therefore preferred for the purpose of making the smaller joints of fishing-rods. It is soft and close-grained, and is said to resist decay for a long time, when exposed to the weather. Its odor is supposed to be disagreeable to insects and worms, to whose attacks it is said not to be liable; for which reason it is sometimes used as the material for bedsteads, and for trunks and drawers for clothes. It is also used for rafters and joists; as fuel, it is little esteemed, as it snaps in the fire like the wood of the chestnut.

In the southwestern States, the dried leaves are much used as an ingredient in soups, for which they are well adapted by the abundance of mucilage they contain. For this purpose, the mature green leaves are dried and powdered, the stringy portions being separated, and are sifted and preserved for use. This preparation, mixed with soups, gives them a ropy consistence, and a peculiar flavor, much relished by those accustomed to it. To such soups are given the names *gombo filé* and *gombo zab*.

In Virginia, and the more southern States, a beer, considered a healthy drink for the spring and summer seasons, is made by

boiling the young shoots in water, adding molasses, and fermenting. The taste of the leaves is mucilaginous and pleasant; of the fruit, disagreeably spicy.

For its medicinal properties, the sassafras has long been celebrated. On this account, it was much sought for by the earliest visitors to America; and its roots formed a part of the first cargo exported from Massachusetts.* At that time, it "commanded an extravagant price, and treatises were written to celebrate its virtues." The following account is from Dr. Bigelow's *Medical Botany*, II, p. 144:—

"The bark of this tree has a fragrant smell and a very agreeable spicy taste. The flavor of the root is most powerful, that of the branches more pleasant. The flavor and odor reside in a volatile oil, which is readily obtained from the bark by distillation. It is of a light color, becoming darker by age, very pungent, and heavier than water, so that it sinks in that fluid when the drops are sufficiently large to overcome the repulsion at the surface. The bark and pith of the young twigs abound with a pure and delicate mucilage. A very small quantity of the pith infused in a glass of water gives to the whole a ropy consistence, like the white of an egg. This mucilage has the uncommon quality that it is not precipitated, coagulated, or rendered turbid by alcohol. It continues in a perfectly transparent state when mixed with that fluid, though it does not unite with it. When evaporated to dryness, it leaves a light-colored, gum-like residuum.

"The volatile oil and the mucilage appear to contain all the medicinal virtue of the tree.

"The bark and wood of the sassafras were formerly much celebrated in the cure of various complaints; it is now recognized only with regard to its general properties, which are those of a warm stimulant and diaphoretic."

A decoction of the bark is said to communicate to wool a durable orange color.

The sassafras is found as far north as Canada. It is there, however, a small tree, not often exceeding fifteen or twenty feet in height. In the Middle States, it is found forty or fifty

* Gosnold, in *Belknap's American Biography*, I, 238.

feet high, and two feet in diameter, and in the Southern and Western States, is said to attain a still loftier stature. "From Boston to the banks of the Mississippi, and from the shores of the ocean in Virginia to the remotest wilds of Upper Louisiana beyond the Missouri, comprising an extent in each direction of more than one thousand eight hundred miles, the sassafras is sufficiently multiplied to be ranked among the most common trees."—*Michaux*, II, 145.

It is found in almost every part of Massachusetts, and seems to flourish in almost every kind of soil. In the vicinity of Boston, in soil resting upon crumbled *grauwacke*, it attains larger dimensions of diameter and height, than I have elsewhere observed it. It is nowhere found very abundantly, but is usually allowed to remain, out of regard for its medicinal properties, and the beauty of its foliage and fruit, about fences, and on the borders of fields, where it is most frequently seen. This tree has the credit of having aided in the discovery of America, as it is said to have been its strong fragrance, smelt by Columbus, which encouraged him to persevere, and enabled him to convince his mutinous crew that land was near.

The sassafras never grows to the size of a tree of the first class. One was growing in 1842, in West Cambridge, which measured more than three feet through at the base, and rose, without a limb, more than thirty feet, with a trunk very straight and slightly diminished, above which it had a somewhat lofty and broad head. It was nearly sixty feet high, and had been long growing by itself. It was felled and its roots dug up, *to allow a stone wall to run in a right line*. Such pieces of barbarism are still but too common. A tree so beautiful and lofty, and of such rare dimensions, such an ornament to a bare hill-side, sacrificed to the straightness of a wall!

The sassafras has been much cultivated in England as an ornamental tree. It is usually propagated by seeds imported from this country. These, as soon as received, are sown or put in a rot-heap, as they sometimes remain two or three years in the ground before they come up. It may be also propagated by suckers which spring up in great numbers from the long creeping roots of old trees.

Several other species of sassafras are found in this country.

XII. 2. FEVER BUSH. SPICE BUSH. *BENZOIN ODORIFERUM*. Nees Von Esenbeck.

The spice bush is a shrub, from four to ten feet high, with long, tapering, brittle branches. The recent shoots are smooth, and of a bright green, which, in the next year, takes an olive tint, and afterwards a pearly gray, which becomes darker on the older stalks. The leaves are from two to five inches long, and one or two wide, scattered, very entire, broad lanceolate or obovate, sometimes almost rhomboidal, tapering at base, abruptly pointed, sometimes obtuse, smooth and of a pleasant soft green above, pale or glaucous beneath; revolute and delicately ciliate on the margin; supported on leaf-stalks about half an inch long, smooth or rarely downy. In April, or the early part of May, clusters of from three to six flowers, of a greenish yellow, on very short pedicels, appear from buds distinct from the leaf-buds, in the axils of the last year's leaves. What seem to be petals, are a calyx of six oblong, obtuse segments. The stamens are somewhat shorter, nine in number, in two rows, six exterior, and three interior, alternating with stamen-like bodies; the filaments of the inner series trifid, with the lateral segments short and terminating in two-lobed glands. Anthers two-celled, cells opening by vertical elastic valves. Ovary roundish, surmounted by a short thickish style. Fruit a dark red or purple drupe, of an oval shape, in bunches of from two to five, by the side of the base of the short leaf-branches, which are sometimes abortive. The stem is short and stout, not so long as the fruit. While green, the drupe has the black style in a terminal hollow.

This plant is remarkable for its graceful form, and large, handsome leaves, particularly when found growing in the deep shade of a moist forest. Such a situation, where it seems most vigorous, is not favorable to the production of its flowers and fruit.

This plant derives its botanical name from its aromatic odor, resembling gum benzoin. This is to some persons always disagreeable, and when the leaves are bruised, oppressively strong. The bark is stimulant and tonic, and has been used in intermittent fevers. The berries are said to have been sometimes

used in place of allspice. In Pennsylvania, a decoction of the branches is often used as a medicinal drink for horned cattle in the spring of the year.—*Darlington*.

Two or more species of Benzoin are found in the Southern States. Nuttall proposed, while the Sassafras and Benzoin were still united with *Laurus*, to separate them from the other species, and unite them in one genus *Euosmus*.

FAMILY XIII. THE MEZEREUM FAMILY. *THYMELACEÆ*.
LINDLEY.

This contains shrubby plants wanting a corolla, but having a corolla-like, colored calyx, and a very tough bark. The calyx is tubular, with its border usually four-cleft, and with four or eight stamens, growing from its tube. Most of the plants belong to the Cape of Good Hope and Australia; many are found in the cooler parts of India and South America; a few in Europe and Middle Asia; a single genus is found in North America.

The plants of this family are distinguished for an acrid or caustic principle in the bark. When chewed, it produces a burning sensation in the mouth, and, taken into the stomach, causes heat and vomiting, or purging. Applied externally, it slowly produces a blister. The bark is made up of interlaced fibres of great strength, from which cordage has been made. A sort of natural lace is formed of it, in the Lagetta, or Lace Bark of Jamaica. In Nepaul, paper has been manufactured from it. A yellow dye for wool is formed from two plants of this family, in the south of Europe.

THE LEATHER WOOD. *DIRCA PALUSTRIS*. L.

Figured in Bigelow's Medical Botany, Plate 38.

This is a much branched shrub, from three to five or six feet in height. The tough, flexible, dichotomous branches which come from the bottom of the stem, have a horizontal tendency,

making the plant look lower than it is; they have a jointed appearance, each joint enlarging upwards, and seeming to have been drawn out from the one below it. Bark grayish yellow, very tough. On the last year's shoots, it is of a greenish or yellowish bronze, with a pearly lustre. Leaves alternate, two or three inches long, and half as wide, oval or obovate, entire, tapering at each extremity, green and smooth above, pale or whitish and rather downy beneath, on short stalks. The flowers appear in April or May, and fall before the leaves expand. "Previously to their emerging, they exist in miniature within a small hairy bud, which occupies a sheath or cavity in the end of each flowering branch."* There are usually three from each bud, with their short footstalks cohering. They are half an inch long, of a pale or greenish white or yellowish color, pendent, lateral, from the midst of the young unexpanded leaves. The corolla-like calyx is monosepalous, tubular, trumpet-shaped, or bell-shaped, contracted at base, and in the middle, enlarging upwards, and ending in an irregularly and slightly toothed border. Stamens eight, alternately longer, conspicuously terminated by ovoid anthers, projecting, on slender filaments, which proceed from the lower part of the tube. Style curved, somewhat longer than the stamens, proceeding from the side of a roundish ovary. Berry small, oval, containing one, compressed, ovate seed.

This plant grows in wet, marshy and shady places from Canada to Georgia. It is conspicuous, when in flower, for the number of its yellow blossoms, which fade and fall rapidly as the leaves expand.

The peculiar properties of the family are remarkable in this plant. The fresh bark produces a sensation of heat in the stomach, and at last brings on vomiting. The wood is very pliable, and the bark of singular tenacity and toughness. It has such strength that a man cannot pull apart so much as covers a branch of half or a third of an inch in diameter. It is used by millers and others for thongs. The aborigines used it as cordage.

* Bigelow.

FAMILY XIV. THE CROWBERRY FAMILY. *EMPETRA'CEÆ*.
NUTTALL.

This forms a small group of heath-like plants, natives of the northern temperate zone and the southern extremity of South America. It consists of low under-shrubs, with simple, entire, coriaceous leaves, scattered or verticillate, often revolute, without stipules. Flowers in the axils of the upper leaves, sterile, fertile, and perfect, on different or on the same plants, with a calyx of persistent, imbricated scales; stamens equal in number and alternate with the sepals; anthers two-celled, the cells distinct, bursting longitudinally. Ovary three to nine-celled; ovules solitary, ascending; stigma radiating, the number of its rays equal to that of the cells. Fruit fleshy, globular, three to nine-celled, three to nine-seeded.

This family was proposed by Mr. Nuttall, to contain the *Empetrum* and *Ceratiola*. It includes only these and *Corèma*, and the genus found in this State, *Oakèsia*. Mr. Nuttall pointed out its distant affinity to *Taxus* among the Coniferæ. The resemblance to the Heaths in appearance and habit is striking.

Little is known of the properties of this family. Linnæus informs us that the fruit of *Empetrum nigrum*, of the north of Europe, is eaten by many animals, and even by man.

Of this family, I believe there is but one plant known in Massachusetts. It is the—

OAKÈSIA. Tuckerman.

Of which there is one species,

THE PLYMOUTH CROWBERRY. *Oakèsia Conradi*. Tuckerman.

First noticed by Mr. Conrad among the pine barrens of New Jersey, and called after that gentleman by Dr. Torrey; separated from *Empetrum*, and called *Tuckermánia*, by Dr. Klotzsch, in honor of Mr. Edward Tuckerman, but named by the latter *Oakèsia*, in honor of William Oakes, Esq.

It clothes one open, sunny hill of some acres, in Plymouth, with a low, brown, uniform dress, strongly reminding one of the description of the heaths of Europe. In the end of March, or the beginning of April, the numerous purple, terminal blossoms, give to this spot an air of gaiety, in striking contrast with the sere and melancholy waste every where around, when little else, except the beautiful and fragrant May-flower, *Epigæa*, gives evidence of the approach of spring. The lovers of nature in this town of the Pilgrims, have the pleasure of announcing the agreeable news, by presents of the *Oakèsia* and the *Epigæa* to their friends at a distance. A favor of this kind, from my friend Mr. Gilbert, gives me the opportunity of describing this plant.

It rises a foot or two from the ground, forming large, crowded tufts. The stem is small and round, of a reddish color, with an ashy bark. The short branches are in imperfect whorls or stages; their ends are covered with the thickly set leaves, closely scattered or in whorls of three. Leaves very short, needle-like, so completely revolute at the edge, as to form almost a cylinder. Male flowers in terminal bunches of ten to fifteen, consisting of three to six, brown, membranaceous scales, enclosing three stamens. Filaments long threads, supporting on their summit a bi-lobed anther, free at each extremity, and opening longitudinally on the external sides.

The plants bearing the female blossoms have leaves of a lighter green. These flowers also are terminal in clusters of about twelve. Each flower consists of one ovary surmounted by a trifid style, encircled by three delicate equal scales, in the axis of one which is ovate, ciliated at the margin and acuminate. Some plants are found bearing perfect flowers. The stamens and pistils are purple, the encircling scales brownish.

CHAPTER IV.

MONOPETALOUS PLANTS.

FAMILY XV. THE OLIVE FAMILY. *OLEACEÆ*.

THE Olive, the Lilac, the Ash and the Privet, with some other less known but hardly less dissimilar shrubs and trees, form this family. It is apparently made up of discordant materials, but their analogy in nature is proved, not only by their distinctive characters, but by the fact, that all the species are capable of being successfully grafted on each other. The Lilac will graft upon the Ash and the Fringe tree, and the Olive will take on the Phillyrea and even on the Ash itself.—(*D C., Prop. Med.*, 206.) The essential character is as follows.

The plants belonging to it are trees or shrubs with opposite branches, four-cornered or compressed branchlets, opposite, entire, simple or pinnate leaves, without stipules. The flowers, in terminal or axillary racemes or panicles, perfect, or sometimes wanting stamens or pistil; with a persistent calyx of four parts or divisions; a corolla of four petals, sometimes distinct, sometimes united, rarely altogether wanting; two stamens, (sometimes more,) and a two-celled ovary with a very short style. The fruit is various; frequently it is a one-celled, one-seeded drupe, as in the olive; sometimes a capsule with two valves; sometimes a winged capsule or key, as in the ash. The plants of this family, chiefly natives of temperate climates, present various claims to the consideration of man; some of them produce durable and elastic wood; others, fruits full of a valuable oil, or important as articles of food; some of them, fragrant and showy flowers; others, medicinal juices.

The bark and leaves of the greater part are bitter and astringent; the bark of the ash, especially, possesses these properties to such a degree, that it has been successfully employed as a substitute for Peruvian bark in the treatment of fever. From

the bark of some species of the flowering ash, exudes the mild and useful purgative known by the name of *manna*. The olive is one of a very few plants which yield oil from the fleshy part of their fruit, it being almost universally confined to the kernel or seed. The sap of the ash has some resemblance to that of the maple.

The family is divided into three sections, each of which has a representative, indigenous or introduced, in our forests or gardens:—

1. THE OLIVE TRIBE,—whose fruit is a drupe or berry, comprehending, with the Olive, the Privet, the Phillyrea, and the Fringe Tree, or Snow Flower;

2. THE LILAC TRIBE,—fruit a capsule; containing the Lilac and the Fontanesia;

3. THE ASH TRIBE,—fruit a key; the Ash and the Ornus, or Flowering Ash.

1. THE OLIVE TRIBE. *OLEIFNEÆ*.

The only genus which has become naturalized, is

XV. 1. THE PRIVET. *LIGUSTRUM*. Tournefort.

This genus contains a very few shrubs or low trees, indigenous to the temperate regions of Europe and Central Asia, with opposite, entire, smooth leaves, and flowers in terminal panicles. The calyx is short and four-toothed; the corolla has a short tube, longer than the calyx, with its border four-lobed. Stamens two, with short filaments attached to the tube of the corolla. The ovary is two-celled, with two ovules in each cell, and surmounted by a very short style bearing a two-cleft stigma. The berry is two-celled with one or two seeds in each cell.

THE COMMON PRIVET OR PRIM. *L. vulgare*. L.

A hardy shrub, with numerous opposite branches, growing to the height of six or eight feet. It grows in clumps, from strong, matted, bright yellow roots. The bark on the trunk is of a dark

pearly ash color. The branches are grayish, recent shoots greenish gray, smooth, or with a delicate, silken pubescence. The leaves are small, on very short stalks, crowded in tufts or opposite on the growing shoots, lance-shaped, acute at both ends, entire, pale green and smooth on both surfaces.

Flowers white, in short terminal panicles made up of opposite short branchlets, with a slender bract at base of each, on which the flowers are in opposite pairs. Footstalk very short, white, with a minute white bract beneath; calyx short, ending in four very obtuse teeth; corolla a short tube, with four oblong, expanded, pointed segments. Stamens two, short, growing to the inside of the tube; anthers large, sulphur-colored, soon turning brown; pollen sulphur-colored, fragrant. The berries are of a shining black. In the south of England, the privet is evergreen. Here, the leaves fall, but later than those of most other plants. It is not a native, but was introduced from Europe, and has spread extensively in the eastern part of this State.

The leaves and bark are bitter and astringent. In Belgium, and some other parts of the continent of Europe, the small twigs, clipped in June, dried and powdered, are used in tanning leather. From the berries a rose-color is obtained for tinting maps; and their juice, with the addition of alum, is used to dye wool or silk green. An agreeable oil for culinary purposes and for lamps, or making soap, is obtained from the berries, by a process of grinding and pressure. In France and Great Britain, the privet is much used as a hedge plant, either alone or with other plants. Its use for this purpose is recommended by the beauty of the foliage, the flowers and the berries, by its rapid and easy growth, and by the fact that it grows well under the drip of other trees, except evergreens. It flourishes on almost any soil, as may be easily seen, from the variety of ground on which it has sown itself, in the vicinity of Boston, and it is propagated by seed or by cuttings, and requires very little pruning.

The privet of Nepaul, which, in its native climate, is a tree, but, as cultivated in Europe, a shrub, is the only other species known.

Several species of *Phillyrea*, and the Virginian Fringe tree, *Chionanthus Virginica*, are cultivated in our gardens for their beauty as ornamental shrubs.

The representative of

2. THE LILAC TRIBE,

THE LILAC, *SYRINGA VULGARIS*,

“Various in array, now white,
Now sanguine, and her beauteous head now set
With purple spikes pyramidal,”

was one of the first plants introduced by our forefathers, and it is universally found; often, in the front of ancient houses, growing almost to the size of a tree. The more delicate Persian lilac, *S. Persica*, is getting gradually into favor.

3. THE ASH TRIBE. *FRAXINEÆ*. BARTLING.

Distinguished by having its fruit a single samara or key, contains the genera *Fraxinus* and *Ornus*.

XV. 2. THE ASH. *FRAXINUS*. Tournefort.

The ashes are lofty trees, with deciduous, compound, unequally pinnate, articulated leaves, axillary and terminal scaly and downy buds, and flowers in lateral, crowded panicles, rising from the axis of the last year's leaves. They are found abundantly in North America, in smaller numbers in Europe and Central Asia, rarely in Eastern Asia.

The flowers are perfect, or wanting stamens or pistils, on distinct plants or on the same plant: usually the two sexes are found on different trees. The calyx and corolla are four-parted or wanting. Stamens two. Ovary free, two-celled. The fruit is a one-seeded samara or key, cylindrical at base, compressed above, and ending in a long, membranous wing. The ashes are usually without a corolla. From this circumstance, the family is properly placed next those which have never a corolla.

The ashes yield to the oaks alone in the number and importance of their uses. The timber of no other tree of Europe or

of the United States, equals ashen timber in elasticity; and its hardness and strength, and other valuable properties, are so considerable, that of our species as of that of England, might be pronounced the eulogium of Spencer:—

“The ash for nothing ill.”

“It serves the soldier,” as Evelyn says, (pp. 156–7,) “and heretofore the scholar, who made use of the inner bark to write on, before the invention of paper. The carpenter, wheelwright and cartwright find it excellent for ploughs, axle-trees, wheel-rings, harrows, bulls; it makes good oars, blocks for pulleys and sheffs, (shieves,) as seamen name them. For drying herrings, no wood is like it, and the bark is good for the tanning of nets; and like the elm, for the same property, (of not being so apt to split and scale,) is excellent for tenons and mortices; also for the cooper, turner, and thatcher; nothing is like it for our garden palisade-hedges, hop-yards, poles and spars, handles and stocks for tools, spade-trees, &c. In sum, the husbandman cannot be without the ash for his carts, ladders, and other tackling, from the pike to the plough, spear and bow; for of ash were they formerly made, and therefore reckoned amongst those woods which, after long tension, has a natural spring, and recovers its position; so as in peace and war it is a wood in highest request. In short, so useful and profitable is this tree, next to the oak, that every prudent lord of a manor should employ one acre of ground with ash to every twenty acres of other land, since in as many years it would be more worth than the land itself.”

There are three species of ash growing in Massachusetts,—the White, the Red, and the Black. The Yellow is found in Maine, and may, perhaps, belong to this State.

Sp. 1. THE WHITE ASH. *F. acuminata*. Lamarck.

Figured in Michaux, Sylva, III, Plate 118.

The white ash is a graceful tree, rising, in the forest, to the height of seventy or eighty feet, with a straight trunk and a diameter of three feet or more at the base. On an open plain,

it throws out its branches with a gentle, double curvature, to a distance on every side, and forms a broad, round head, of great beauty. The trunk is covered with a whitish bark, which, in very young trees, is nearly smooth; on older trees, it is broken by deep furrows crossing each other obliquely, into irregular, square, or lozenge-shaped plates, and on very old stems becomes smooth again from the rough plates scaling off. The bark of the branches is smooth, of a grayish green, indistinctly dotted with gray; while, on the somewhat stout young shoots, it is of a smooth, polished, deep green, with long white dots.

The leaves are opposite, compound, twelve or fifteen inches long, the stalks much swollen at base and at the joints, round, smooth, and tapering. The leaflets are usually seven, (five to nine,) from three to five inches long and one or two broad, on compressed petioles, channelled above, four or five lines long. They vary in form from egg-shaped to lance-shaped, elliptic, oblong and inversely egg-shaped, tapering to a long point, rather acute at base, entire or slightly dentate, or serrate, smooth above, very pale or glaucous, and somewhat hairy along the veins beneath. The odd leaflet is on a long stalk. The young leaves are very downy, but become almost perfectly smooth. The buds are short and rust-colored, smooth; terminal buds large.

The flowers are in opposite fascicles or bunches, near the ends of the branches, in the axils of the last year's leaves. The fertile flowers are on a smooth, branched, tapering, purplish rachis, with opposite branches, each branch terminating in a flower. Calyx deeply two-parted, the parts divided slightly. Ovary flattened, elliptic; style tapering; stigma bifid. The footstalks have two opposite scales, like bud-scales, near the base, and beneath each ramification. In the fertile flowers, the two sterile stamens, when present, are opposite, at the base of the ovary. The staminate are in close, dense, much-branched fascicles. At the end of each very short branch, in a flat cup with four teeth, are two sessile or nearly sessile brown stamens, parallel and one eighth of an inch long. The keys or samaræ are on angular, tapering, diverging stalks, dividing by threes, and from five to seven inches long. The keys are one and a half inches long, cylindrical at the base, which is surrounded

by the minute, jagged calyx, and expanding upwards into a flattened wing, two or three lines broad, rounded or rarely notched at the extremity.

The flowers appear in May, before the opening of the leaves, and the keys are mature in August and September, about which time the leaves turn to an olive or olive purple. The keys often remain on the tree through the winter.

The white ash is found in every part of the State and on every kind of ground, but flourishes best in a deep, loamy soil, near the banks of a river or in a moist meadow. "By the banks of sweet and crystal rivers and streams," like the English ash, it is observed to thrive infinitely. It is sometimes seen nestling among rocks, where it can hardly get foot-hold, and is frequent on the steep sides of the Hoosic mountains. In swamps, it gives place to the black ash. In the old forests, in the narrow valleys in the western part of the State, it towers to a great height. Not unfrequently, it may be found one hundred feet high and more, with a diameter of four feet and upwards. Sixteen years ago, an ash was felled in Granville, which was rived into three thousand rake-stalks. It was four and a half feet in diameter, and had a shaft of seventy feet without a limb. It grew on the land of Zelotes Robinson, now of Blandford. Standing by itself, the ash rarely attains a great height. There is, growing at the corner where the road from Hingham Plain to Cobasset unites with that from the Old Colony House, an ancient tree, which measured, in July, 1839, four feet two inches through, at four and a half feet from the ground, and four feet eight inches just below the branches. At seven or nine feet from the surface, ten large branches go off, horizontally, or with a slight inclination upwards, forming a broad space above them, on which seats have been placed.

The ash has been called the painter's tree. It is, at least, while young, remarkable for its gracefulness, for the light and easy sweep of its branches, and for the softness and mellow green of its foliage. It produces a fine effect in contrast with the darker woods, and should, on that account, always have a place, were it the object to exhibit the various beauty of the forest trees. Its leaf comes out late, and, although beautiful

while it lasts, and turning to a rich, mellow, olive purple, for some time before it falls, it falls early. It should not often, therefore, stand alone, in a conspicuous place, but in a corner among other trees.

The wood is white, and remarkable for its toughness and elasticity. For these qualities, it is used for hoops, for handles of pitch-forks and rakes, and for the shafts and springs of wagons and other carriages. It is used to make oars, in preference to any other wood. The oars, already made, are brought to Boston, from the Penobscot and Kennebec Rivers, in Maine. They are made of forest ash, which is considered lighter and more springy than any other. It is also used for ship's blocks, for which purpose, it is wrought in a green state, as it is then almost as soft as pine. It is used for the boxes of pumps, almost exclusively. White ash, from Maine, is used, for its superior softness, for the bodies, brackets, sills and pillars of carriages; a tougher variety, from the interior or from the west, being preferred for shafts, springs and bars, requiring strength. Lance-wood alone, as more elastic and strong than ash, is preferred for carriage shafts. Ash is also used for sofa frames and chair frames, for backs and bottoms, for staves for inferior casks intended for dry articles, and for bowls.

The leaves and branches of the ash are said to be so offensive and perhaps poisonous to serpents, that they will not come nigh them. The leaf is also said to give relief in case of a bite from poisonous serpents. This property is of small consequence in New England, where poisonous serpents are few, and probably confined to the single species of the common rattlesnake. A more important property has been tested. An ash-leaf rubbed upon the swellings caused by mosquitoes, removes the itching and soreness immediately. The same effect is produced on the poison occasioned by the bite of the bee. A decoction of the leaves is said to be an antidote to the poison of lamb-kill, *Kalmia angustifolia*, when taken by lambs.

Sp. 2. THE RED ASH. *F. pubescens*. Walter.

Figured in Michaux, Sylva, III, Plate 119.

In its appearance, the red ash so strongly resembles the white, that it is usually confounded with it. It is easily distinguished by the down on the recent branches and on the footstalks and lower surface of the leaves. The distinction is important, as the wood is less valuable than that of the white. It is found in nearly the same situations, delighting in a moist, rich, loamy soil, where it grows to a good size, though never to so great a height as the white ash. On the rich intervale land on the Connecticut River and its tributaries, it is often found over three feet in diameter, and fifty or sixty feet high. A few rods south of the great *Celtis*, in Springfield, I measured one in September, 1840, which was ten feet four inches in circumference at the surface, and nine feet at three feet above. The red ash is a spreading, broad-headed tree, and rises to a considerable height only in the forest. The trunk is erect and branching, covered with a dark ashy or granite gray bark, with numerous longitudinal, superficial furrows, not often running into each other.

The branches are opposite, grayish, conspicuously dotted, the younger ones green, or olive green; and the recent shoots, with the footstalks and under surface of the leaves, clothed with a soft, velvety, grayish or rusty down.

The last year's shoots are somewhat downy in appearance, but not in reality. Near their extremity, in the axils of the last year's leaves, are the flower branches. They are, when the fruit is mature, three or four inches long, single, or in threes, dividing by nearly opposite divisions, and subdividing, the subdivisions bearing at intervals single or double pairs of fruit or keys, on short, thread-like stems. The keys are one and a half or two inches long, and two or three lines broad, cylindrical below, broader, flat and thin above, rounded and with sometimes an abrupt point at the extremity. Closely adhering to the base is the slit calyx, ending in four jagged teeth.

The leaves are opposite, ten to fifteen inches long, consisting

of three or four pairs of leaflets and an odd one, on a round footstalk, which is channelled above and swollen at the base and at the articulations of the leaflets. The leaflets are three to six inches long and one to one and a half wide, on very short, compressed, downy footstalks, generally ovate-lance-shaped, acute or rounded at base, tapering to a long point, entire or obscurely toothed above, entire below, the upper surface smooth or somewhat hairy, the under surface paler and somewhat downy. The buds are rounded, almost concealed by the leaf-stalk, downy and of a dark rusty brown. In autumn, the leaves become russet. The fruit remains after the leaves have fallen, and, on the male trees, as is common on the other ashes, are unsightly excrescences from the sterile blossoms.

Sp. 3. THE BLACK Ash. *F. sambucifolia*. Willdenow.

Figured in Michaux, Sylva, III, Plate 122.

The black ash is the slenderest deciduous tree, of any considerable magnitude, to be found in the forest, often attaining the height of seventy or eighty feet with a diameter scarcely over a foot. It is almost confined to swamps or the muddy banks of rivers, where the ground is saturated with moisture through the greater part of the year. In such situations, it often throws up its arrowy shaft almost without a limb, until its top reaches the sunshine, among the tall hemlocks, spruces, hachmatacks, birches and maples. Yet, when planted on an open plain, where the soil is rich and not too dry, it spreads abroad its limbs and forms an ample, round head. It is easily distinguished from the other ashes by its *sessile*, serrate leaves, and its dark blue or black buds, and not by the color of the bark, in which there is not a striking difference. The trunk is of a dark granite gray, the bark rough, with small, superficial, vertical rugosities, which appearance continues in very old trees.

The young shoots, which are very stout, are of a yellowish ashy gray, dotted with lighter dots, and next year becoming of a clear gray, somewhat darker on the older branches; on these, the dots have the appearance of large warts. The semi-circular leaf-scars are large and conspicuous on the smaller

branches. The leaves, which come out late and fall early, are of a yellowish green, twelve or fourteen inches long, opposite, compound, with two to five pairs of leaflets, usually four pairs, and an odd one, on a leafstalk, which is large at the base, somewhat flattened below the leaflets, and flattened or channelled above with a sharp-edged channel. The lateral leaflets are sessile, narrow, ovate-lance-shaped or oblong, rounded at base, gradually tapering to a long point, serrate, smooth but impressed at the veins above, paler and hairy along the lower part of the mid-rib beneath. The terminal one is regularly lance-shaped, on a short footstalk. The buds are short and round, terminating in a point, and of a deep blue or black color.

The flower branches are opposite, single or in threes, in the axils of the last year's leaves. They are from three to six inches long, dividing irregularly, and not much branched. The flowers differ from those of the other ashes in the absence of a calyx. The keys are a little more than an inch long, elliptic, obtuse or slightly notched at the end, which is sometimes surmounted by the style, compressed and winged throughout. They are mature in September or October. In autumn, the leaves become russet.

The wood of the black ash is remarkable for its toughness. On this account, it was preferred to every other, by the Indians, for the manufacture of baskets, and is still used for that purpose in preference to every kind of wood, except that of the trunk of a young white oak. When it is to be divided, it is beaten with mallets until the fibres are somewhat loosened, and it may be then separated into thin, uniform ribbons of any required dimensions. It is also somewhat used and was formerly much more so, for chair-bottoms and grain-riddles, and for hoops. Its sap, procured by exposing a green branch to the fire, is a popular application for ear-ache.

Of the other ashes that would flourish in our climate, the most valuable, doubtless, is the common European Ash, *F. excelsior*. This has been introduced and found to grow as readily and as vigorously as any of the native species. It is considered, in England, as among the noblest and most beautiful of the forest trees, and next to the oak in the value of its timber. In

the neighborhood of London, the plants, at two years from the seed, may be procured at 3s. per 1000; transplanted plants, one foot or more in height, at 10s., about \$2 25 per 1000. Some of the many varieties, particularly the weeping ash, are prized for their beauty.

The green ash may, hereafter, be found in Massachusetts, as it occurs in Canada. There are many other ash trees, probably thirty, but these are the best.

FAMILY XVI. THE HOLLY FAMILY. *AQUIFOLIACEÆ*.

DE CANDOLLE.

This consists of evergreen or deciduous shrubs or trees, with alternate or opposite leaves, which are often smooth and coriaceous, and small, solitary or fascicled perfect flowers, or flowers wanting stamens or pistil, growing from the axils of the leaves.

The calyx and corolla are imbricate in the bud before opening. The calyx has four or six divisions. The corolla four to six lobes, united at their base, and there are as many stamens, inserted into it and alternate with its lobes. The ovary has two, six, or eight cells, with a pendulous ovule in each. The fruit is fleshy, and opens not spontaneously, with from two to six stones, each containing a pendulous seed.

The plants of this family are found in various parts of the world; three genera only in New England. Several of them have valuable properties. The bark and leaves of the European holly have been found efficacious in intermittent fevers. The famous Jesuits' tea of Paraguay is made of the leaves of another species of holly. Five millions of pounds are annually produced in that country. An inferior tea is made from another species in Brazil. The aborigines of the Southern States made great use of the infusion of a species of holly as a purifier of the system, and of that made from another plant of this family as an agreeable stimulant. The properties of a species of winter berry will be spoken of hereafter. Many of the species are favorites with the gardener, for their brilliant, evergreen foliage.

XVI. 1. THE HOLLY. *ILEX*. L.

The hollies are evergreen shrubs or small trees, with leaves usually coriaceous, and often bordered with thorny teeth, and white, axillary flowers, commonly perfect, but often with the fertile and sterile on different plants. They are distinguished by their four-celled ovary, with four sessile stigmas, and their berry-like drupe, with four, one-seeded nuts. The hollies are found in North and tropical America, in the warmer parts of Asia, and a single species in central and northwestern Europe. Their wood is remarkable for its hardness, whiteness, and closeness of grain, and for its susceptibility of receiving color and polish. There are about forty species in the genus.

THE AMERICAN HOLLY. *I. opàca*. Aiton.

Figured in Michaux, Sylva, II, Plate 84.

The American holly is a handsome, low tree, with nearly horizontal branches, and thorny, evergreen leaves. The erect trunk is clothed with a smooth bark, of an ashy gray, resembling that of the beech, but somewhat lighter. On the older trees, it is usually overspread with grayish parmelias and lecanoras, and other bluish, whitish, and gray lichens. The recent shoots are of a yellowish or olive gray, with a slight, downy powder, afterwards becoming of a clear gray. It is found growing in company with the red maple, the tupelo, the yellow birch, the black oak, and the cedar.

Leaves on short footstalks, evergreen, oval-oblong or elliptic, acute at both ends or somewhat angled at base, with several large teeth ending in stiff spines, leathery, smooth and shining above, paler or greenish yellow, with bright green veins, beneath. At their base, when recent, a pair of awl-shaped, brown stipules may be seen.

The perfect or fertile flowers are solitary, at the base of the recent shoots, on stems half an inch long, beneath the base of which are a lanceolate, membranous, brown, fugacious scale, and two minute, pointed, more permanent ones at its sides; and above the middle are two appressed, minute, pointed, green

scales. The calyx has four triangular, pointed, ciliate teeth. The corolla, four oblong, roundish, white segments, with greenish veins. The stamens are four, from the base of the corolla, between its segments, and two thirds as long. The ovary is large, egg-shaped, green, crowded with a sessile stigma, with four rounded angles. The berries are scarlet, contain four stony seeds or nuts, and remain on the tree into the winter. It flowers in June.

This tree is found plentifully at Quincy, at Cohasset, and especially at New Bedford, and on Naushton Island. It has considerable beauty, and is particularly valuable for retaining its bright green leaves through the year, and for the beauty of its scarlet berries. The leaves are seldom touched by an insect. On these accounts, it deserves cultivation as an ornamental tree. It has great resemblance to the European holly, which makes the most durable hedge of any plant whatever, and one which is kept in repair, when once established, at the least expense. The objection to it is the slowness of its growth. Our tree is commonly found on a rather dry, sandy, or rocky soil, but will grow on almost any. The European is found to do best on a rich, sandy loam, in an open forest of oak. It is propagated by seeds or by plants taken from the woods. The seeds do not germinate for more than a year after sowing; they are, therefore, kept in moist earth for a year after gathering, after which they are sown at the depth of a quarter of an inch, in fine soil. The surface should be protected from heat and drought, by a covering of half-rotten leaves or litter. When transplanted, they should still be protected, for a while, from the heat of the sun. The best time for transplanting is early in spring, before the plant has begun to shoot.

The wood of the holly is compact and of a beautifully close grain and satiny texture. The sap-wood is white, the heart-wood brown. Both are very hard, when seasoned, and susceptible of a brilliant polish, in their natural state, and when colored; and are used in as great quantities as can be procured, by turners, by screw-makers, by whip-makers for the handles of whips, by engravers, and by cabinet-makers for inlaid work. For these various uses, the wood is brought into Boston, in

pieces usually fifteen or sixteen inches long, and from one to six inches thick.

From the bark of the European species bird-lime is made; and the berries of our species, as well as of some others, have emetic properties.

The American holly has not been found farther north than Massachusetts. By Michaux it had not been observed north of Long Island. It is found in all the Southern States, and westward as far as Tennessee.

Seven or eight other species are also found growing in the southern part of the United States.

XVI. 2. WILD HOLLY. *NEMOPANTHUS*.* Rafinesque.

A genus of a single species, with sterile, fertile, and perfect flowers on the same or on distinct plants; a very minute, four (or five) toothed calyx; a corolla of four (or five) distinct, oblong-linear, fugacious petals; stamens four or five, longer than the corolla and alternating with its petals; ovary hemispherical, with four cells; style none, stigma four-lobed; fruit a round, four-seeded berry.

THE WILD HOLLY. MOUNTAIN HOLLY. *N. Canadensis*. Michaux.

A beautiful, slender shrub, rising to the height of six or eight feet, and in swamps sometimes to ten or twelve. The recent shoots are purple or olive, with round, gray dots, which, after the second year, are scarcely to be perceived. The larger branches are greenish gray, growing darker and purplish, and finally, on the older stems, covered with various, white, gray and brown, membranous lichens. The leaves vary in shape, from a short, broad oval, to oblong, and inversely lance-shaped, tapering at the base, acute at the end, or rounded with an abrupt point, very smooth and entire, or with a few distant serra-

* Rafinesque, in Silliman's Journal, proposes the name *Nemopanthus*, which, he says, means "flower with a filiform peduncle," for this new genus. His name should be retained, as he wrote it, if at all, and his generic description, which was communicated in January, 1818, has priority to Prof. Dewey's, which was only suggested, according to Prof. Eaton, in that year.—*Eaton's Manual*, p. 403, note.

tures, of a light green above, paler and finely reticulated beneath.

The flowers are very small, on long, slender, thread-like stalks, solitary or in bunches, at the base of a tuft of leaves or a young branch. The calyx is so small that it seems to be wanting. The corolla consists of four oblong, narrow petals, of pale white, which soon fall. The four stamens alternate with the petals, with rather large anthers on long, slender filaments. The berry is as large as a pea, of a beautiful pale crimson color, ripe in August, and contains four, somewhat prismatic, stony nuts, in a yellowish pulp. It is supported by a stalk of the same color, an inch or more long. The flowers expand in May and June.

The *Nemopanthus* is found in almost all the low, wet woods in the vicinity of Boston and on the southern side of Massachusetts Bay, and in the middle of the State. It is found in Canada, throughout New England, and in New York and Michigan.

XVI. 3. THE WINTER BERRY. *PRINOS*. L.

The winter berry is a genus of twelve or thirteen species of shrubs, some of them evergreen, some deciduous, natives of North America. They differ from the two preceding genera in having their calyx and corolla usually six-parted, with six stamens, and a berry with six seeds. Some of the most beautiful are natives of Massachusetts, and these, with a few others, are cultivated in Europe as ornamental shrubs. The three found here are the Black Alder, *P. verticillatus*, with flowers and fruit in clusters in the axil of the leaves; the Single-berry Black Alder, *P. lævigatus*, with its flowers and fruits larger and solitary; and the Ink-berry, *P. glaber*, with evergreen leaves.

Sp. 1. THE BLACK ALDER. *P. verticillatus*. L.

Figured in Bigelow's Medical Botany, Plate 56.

A handsome shrub, five or six, rarely ten or twelve, feet high, with crowded branches and leaves, conspicuous for its bunches of axillary blossoms, and of scarlet berries, remaining late in the autumn or even into the winter. The recent shoots are clothed

with an apple green bark, which, on the large branches, turns to a pearly gray, and on the older stems is of a polished and clouded dark color, whence the plant derives its common name. The leaves are two or three inches long and half as broad, lance-shaped, oval, or inversely egg-shaped, acute at both ends, often abruptly at the extremity, sharply serrate, smooth above, downy along the prominent veins beneath, on footstalks half an inch long. The flowers are white, the stamen-bearing, in crowded bunches, of from three to twelve in the axils of the leaves, on stems one or two lines long, with minute brown scales at the base. The calyx consists of six small, appressed, rounded or jagged segments. The corolla is of one piece, wheel-shaped, ending in six or seven, rounded, spreading, or recurved segments, just below the angles of which, within the tube, are the short stamens, with large brown anthers opening at the sides and discharging orange pollen. On the fertile flowers, which are single or crowded, on very short stems, the stamens are very short, and the false anthers are white and form a part of the filament. The berries are of a bright scarlet, round, or slightly compressed, about a quarter of an inch in diameter, solitary, or in bunches of two or three, and remain long on the bush. The persistent calyx, at the base, is of a darker color, and the stigma, which crowns the berry, is brown. The pulp is yellowish, and envelops six or eight lunate seeds. The flowers expand in June. The berries are ripe in September.

The bark and berries of the black alder are somewhat bitter and astringent, and have been sometimes substituted for Peruvian bark in the treatment of intermittent fevers. The bark has also been considered of great use, both taken internally, and employed as a wash, in cases of incipient gangrene and in the cure of eruptions on the skin.—See *Bigelow's Med. Bot.*, III, 141.

Sp. 2. THE SINGLE BERRY BLACK ALDER. *P. lævigatus*. Pursh.

Leaves and fruit figured in Abbott's *Insects of Georgia*, II, Plate 86.

A beautiful shrub, six, eight, or ten feet high, with grayish branches, scattered with minute dots of the same color, and a smooth, alder-like trunk with brownish green bark, clouded at

intervals with light gray lichens. Leaves in tufts, or alternate on the upper shoots, on short petioles, lanceolate or broader towards the extremity, acute at both ends, often with a twisted acumination, margin slightly revolute, with a few appressed serratures, light green and shining on both surfaces, smooth, except a slight pubescence along the nerves beneath, from one and a half to two and a half inches long, and one half to three quarters of an inch wide.

The staminiferous flowers are on footstalks from one third of an inch to one inch in length, in the axil of the leaves or bud scales; fertile flowers on very short footstalks, in the axils of the leaves. The fruit, which remains on the stem during a great portion of the winter, is of a rich orange scarlet. It is solitary, three or four tenths of an inch thick, on stems as long as its diameter. The buds are very small.

This plant grows in deep, wet swamps, in Cambridge, and many other parts of the State, and is attractive in June from the multitude of its white flowers, in autumn and winter from its large scarlet berries, and at all times from the glossy lustre of its leaves.

Sp. 3. THE INK BERRY. *P. glàber*. L.

Leaves and fruit figured in Abbott's Insects, I, Plate 35.

An elegant, delicate-looking, evergreen shrub, with slender branches, growing in a few sheltered places in Plymouth and Hingham, to the height of from two to eight or nine feet.

The leaves are lance-shaped or inversely lance-shaped, an inch or more long, one third or one half an inch broad, tapering at base, terminating in an abrupt point; slightly reflexed at the margin, with one or two large, rounded teeth on each side towards the end, polished on both surfaces.

The flowers are solitary, in the axils of the leaves, on thread-like, minutely hairy stalks, half an inch long. The calyx ends in six obtusely pointed lobes; the corolla in six or seven oblong, rounded segments, alternate with which are the white stamens, ending in brown anthers. Ovary green, low, conical, crowned with a broad stigma.

The elegance of the evergreen foliage causes it to be much sought after, to be mingled with bouquets in winter; and for this purpose it is brought from considerable distances, and carefully kept in cellars sometimes for months.

FAMILY XVII. THE MADDER FAMILY. *RUBIACEÆ*. JUSSIEU.

This is a very extensive family, comprehending nearly two thousand species of trees, shrubs and herbs, with roundish or four-sided stems and branches, entire leaves, opposite or in whorls, with stipules between the leaves, often resembling leaves, and with regular flowers.

This family is divided into many sub-orders and tribes, and, with the exception of that, (*Stellatæ*), which includes the Madder, *Rubia*, and the Cleavers, *Galium*, which is made a separate family by some writers, is a remarkably natural one. It is mostly confined to countries within or near the tropics, a few species only occurring far to the north. The properties of different plants of this family are of the greatest importance. Madder, and several species of *Galium* yield valuable dyes and pigments. The roots of Dyers' Cleavers, *G. tinctorium*, were employed by the North American Indians to give to the quills of the porcupine a red color, which neither sun, air, nor water would change. The seeds of some species of the same genus, are a successful substitute for coffee. The Peruvian bark, (*kin-kina*, "the bark of barks,") the best febrifuge known, is obtained from several species of *Cinchona*, natives of Peru, which possess, in very various degrees, the bitter, astringent and alkaline properties, which give them their virtue. *Pinkneya pubens*, the fever bark of Carolina, is reputed to have properties similar to *Cinchona*. Coffee is the horny, albuminous seed of *Coffea Arabica*, the best known and most important species of a numerous group. All the different kinds of coffee known in commerce, are varieties of this one species, originally brought from Mocha, or, according to Raynal, from the moun-

tains of Abyssinia, of which it is a native, and from which it was transported, about the middle of the fifteenth century, to the mountains of the happy Arabia.

The East India coffee plantations are derived from a single plant raised in Batavia, from seed introduced from Mocha in 1690; and those of the West Indies are said to have been produced, also, from a single plant, presented, in 1714, by the Dutch, to Louis XIV. This was multiplied in the Royal Gardens, whence three plants were despatched on board a ship destined for Martinique. Two of them perished in the long and dangerous passage, and the third was kept alive only through the self-sacrificing generosity of the Captain, Declieux, who shared with it his allowance of water. Probably the propagation of no single plant has produced, in modern times, so great an effect upon the habits of mankind.*

Ipecac, one of the most universal emetics, is the creeping, brownish, or grayish root of *Cephaelis Ipecacuanha*, (*D. C.*, IV, 535,) of Brazil, where it is known by the name of *Poyas*.

Several of the genera, *Nauclea* and *Hymenodyction*, furnish woods which vie with box and mahogany in delicacy and beauty; of another, *Siderodendron*, iron wood, the hardest of American woods, is the produce. Several others yield valuable fruits, and a still greater number are remarkable for their magnificent and often odoriferous flowers, and their beautiful foliage.

The coloring properties of this family are found to reside chiefly in the root, the tonic and astringent properties in the bark, the valuable emetic principle in the root, the aromatic principle of the coffee, in the horny seeds. It is in corresponding parts of plants of this family, growing among ourselves, that we are to look for similar properties.

The distinguishing characters of the family are, that the ovary is more or less completely united with the four or five-cleft calyx, into the tube of which the corolla is inserted; the stamens are equal in number to the lobes of the corolla, alternate with them, and growing from the throat of the corolla; and

* The name affords a curious instance of derivation. The Arabic name is *Quahoueh*, or *Kahoueh*, the Persian, *Cahwa*, the Turkish *Cahvey*, French, *Café*, English, *Coffee*.

that the ovary has, in some of the tribes, one, or rarely two ovaries, in others several.

In this family there are two genera belonging to Massachusetts :—

Button Bush, *Cephalánthus*, with flowers in a globose head ;

Partridge Berry, *Mitchélla*, flowers terminal, in twos, on a double ovary.

In the sub-order, *Cinchonæ*, the third sub-tribe, in the division of Torrey and Gray, is

CEPHALA'NTHÆ,—distinguished by its flowers and fruit being sessile and densely aggregated on a globose receptacle, the fruit dry and divisible into two or four parts.

XVII. 1. BUTTON BUSH. *CEPHALA'NTHUS*. L.

American shrubs, with oval or lanceolate, opposite or ternate leaves, short stipules, and flowers crowded on a globular, hairy receptacle, with a calyx tube in the shape of an inverted pyramid, the border four-toothed, a tubular four-cleft corolla, four stamens, fruit inversely pyramidal, leathery, two- to four-celled, separating from the base to the summit into two to four, closed, one-seeded portions.

THE BUTTON BUSH. RIVER BUSH. *C. occidentális*. L.

Figured in Barton's Flora, III, Plate 91.

The button bush is found along the banks of slow streams, forming little islets in muddy ponds, and in other situations in which its roots and the lower part of its stem are immersed in water for a considerable portion of the year. From stout, contorted roots, often several inches in diameter, and from large, prostrate, root-like trunks, it rises with an erect or sinuous stem, to the height of from four to ten feet. On the recent shoots the bark is of a bright, polished, copper color, or olive green, or reddish bronze, with a few brown dots, and turns gradually to a light brown. Afterwards, it begins to crack, and from brown or purplish turns to a dark granite gray. The bark on the older stems is cracked, rough and gray, and often

covered with lichens. The recent shoots are tough; the pith considerable; the older wood light and brittle.

The leaves are opposite, or in threes, of a broad-oval, or lanceolate, or ovate shape, very entire, acute at base, pointed at the extremity, sometimes wavy at the border, smooth on both surfaces, of a bright, shining green above, light and much reticulate, and sometimes downy on the veins beneath; and tough and leathery in texture. They are from three to five inches in length, of somewhat more than half that breadth, and are on stout, channelled, or bordered footstalks, from half an inch to an inch long. Between the footstalks are small, faded stipules, which leave a slight scar when removed.

The globular heads of flowers are on round stalks from one inch to three inches long, terminal, or in the axil of the upper leaves, and hence solitary, or in twos, or threes, or fours, on the ends of the branches; or, as the leaves of the upper whorl are sometimes very minute, they appear in terminal sevens. The flowers appear in June and July, sometimes in August, of a yellowish white, bristling with the long styles, and as they are closely arranged on every side of a small, terminal, globular, fleshy receptacle, they form a spherical head, each flower being compressed into the shape of a four-sided, inverted pyramid. The calyx is short, green, tubular, externally invested with long, silken hairs, is angular from compression, and ends in four rounded lobes. The corolla, when freshly opened, is of a delicate white, but soon turns brown. It is a slender, tapering tube, hairy within, twice as long as the calyx, ending in four, rounded segments, with black points, on short footstalks, at the angles, just within which are the anthers, resting erect on the end of filaments which are attached to the tube of the corolla within. The style is twice as long as the corolla, tapering, and ending in an ovate stigma.

"Button bush, or river bush, is a frequent ornament of the water side, its insulated thickets furnishing a safe retreat for the nests of the black bird, (*Oriolus phæniceus*).” "The appearance of this shrub, on elevated ground, often indicates the presence of springs of water."—*Bigelow Fl.*, 51. It is cultivated in Europe for ornament, recommending itself by its sin-

gular mode of flowering, and by its flowers appearing at a season when few others are to be seen. It grows well in common garden soil, in situations moderately moist, and is readily propagated by seeds, by cuttings or by layers.

The characteristic properties of the family, particularly its tonic power, undoubtedly reside in this plant. The inner bark of the root, according to Elliot, is of an agreeable bitter, and is often used, in the South, as a remedy for obstinate coughs. It has been recommended in affections of the skin. Other properties will probably be discovered.

To another tribe, belongs a singular New England plant, named in honor of Dr. John Mitchell, a botanist of Virginia,—

XVII. 2. PARTRIDGE BERRY. *MITCHELLA*. L.

A genus including two species of smooth, creeping, evergreen plants, with opposite, ovate or rounded, short-stemmed leaves, and axillary or terminal flowers, which in one species are solitary, in the other in pairs, with their ovaries united. The border of the calyx is conspicuous, four-toothed; the corolla funnel-shaped, with a slender tube four-lobed in the border; four stamens, attached to the tube of the corolla; ovary four-celled, surmounted by a slender, long style, bearing four stigmas; fruit a berry, in one species round, in the other oblate-globose, with four, one-seeded nuts.

THE PARTRIDGE BERRY. CREEPING *MITCHELLA*.. *M. repens*. L.

Figured in Barton's Flora, III, Plate 95.

A beautiful little creeping, evergreen plant, with its stem trailing along the ground about the foot of trees, in deep, shady, moist woods, in company, oftentimes, with *Gaultheria*, and the equally beautiful *Linnaea* which it so much resembles. At distances, it throws down hair-like roots; its terminal branches slightly ascending, and with the pairs of roundish leaves, almost completely covering the ground, and forming a carpet, enamelled in spring with the pearly, rose-colored, fragrant twin-flowers, and in autumn with the bright scarlet berries. The leaves are in twos, on short stalks, about the size of the

finger nail, roundish, often orbicular, kidney-shaped at base, rounded at the end, with the veins prominent, of a uniform dark green above, or variegated with a lighter spot and whitish veins; the margin somewhat revolute; under surface perfectly smooth.

The flowers are rose-colored, or white, in pairs, the tubes of the corollas, hairy within, diverging from the united ovaries. The fruit, as large as a whortleberry, broader than it is long, and seeming to be made of two berries grown together, side by side, and crowned with their calyxes, scarlet, with a rather dry, whitish, almost tasteless pulp, containing three or four, small, flattened, lens-like, stony seeds. Flowers in June and July. The fruit remains on through the winter, and contributes to furnish food for the partridge, and other birds that remain in our climate.

FAMILY XVIII. THE HONEYSUCKLE FAMILY. *CAPRIFOLIACEÆ*. JUSSIEU.

This family consists of climbing, trailing, or erect, woody shrubs or under shrubs, and sometimes herbaceous plants, remarkable for their beauty, and some of them much valued, and universally cultivated for ornament. These often fragrant, always beautiful plants, of which there are about eighty species, are natives of the northern parts of both continents, beyond or just within the tropics. The bark of many of them is astringent; and a species of *Lonicera* is used in Chili to dye black. The flowers of the greater part are as remarkable for their delicious fragrance as for their beauty. The fruit is usually, in some degree, emetic or purgative.

They are distinguished by their apparently jointed stems; simple, opposite leaves, with the footstalks of each pair commonly united at base; their flowers perfect, regular, or more commonly irregular, five-parted, in pairs, or heads, with commonly two bracts at the base of the flower-stalk; calyx adherent to the ovary, with its border five-parted; corolla tubular,

with its border five-lobed ; stamens five, sometimes only four, inserted in the throat of the corolla and alternate with its lobes ; ovary three-, sometimes five-celled ; fruit a one-celled, sometimes three- or five-celled berry, with one or several seeds. The woody plants have a soft, light, more or less abundant pith, wood usually brittle, and bark which becomes loose and stringy.

There are four genera found native in Massachusetts :—

The Twin-Flower, *Linnaea*, an humble, trailing, evergreen herb, with four stamens ;

The Feverwort, *Triosteum*, an erect, simple, herbaceous plant with five stamens ;

The Honeysuckle, *Lonicera*, a climber, with one- to three-celled, few-seeded berries ; and

The Bush Honeysuckle, *Diervilla*, an erect plant, with one- to three-celled, many-seeded berries.

XVIII. 1. THE TWIN-FLOWER. *LINNÆA*. Gronovius.

A genus containing a single species, which is a creeping, evergreen herb, indigenous to the northern part of the old and new world, with an ovate calyx-tube, four stamens, two of them longer, inserted into the base of the corolla, a three-celled ovary ; and fruit, a dry, three-sided, one-seeded berry.

THE TWIN-FLOWER OF THE WOODS. *L. borealis*. Gronovius.

Figured in Hooker's *Flora Londinensis*, Plate 199.

In the pine woods in the northern parts of New England, where moss-covered columns support, at a great height, a thick, close top, the shaded ground is often carpeted with the leaves of this delicate and beautiful flower, alone, or intermingled with moss. Its woody stem creeps to the distance of several feet along or just beneath the surface, the raised branches sending out pairs of very small, roundish leaves, and at intervals, a slender, erect thread, bearing a pair of modest, drooping, fragrant flowers, white or tinged with a faint blush of rose-color or purple. The leaves are one fourth or one half an inch long,

nearly orbicular or elliptic, with two or three rounded teeth on each side, and scattered beneath and on the margin with a few hairs. The stem is reddish. The almost capillary flower stem, the bracts at the base of each partial stem, as well as the calyx, are covered with minute, glandular hairs, which are also found on the inside of the corolla. The calyx ends in five lanceolate segments. Beneath the calyx is a pair, sometimes two, of slender, linear bracts. The country people call this plant twin-flower. Botanists have given it a name in honor of Linnæus. How often, in the dark forests of both continents, in the northern parts of which it is widely spread, has the name of the great reformer and systematist been called to the mind of his followers by the sight of this interesting plant!

"Linnæa," says Sir James Edward Smith, "is so called in honor of the great Swedish naturalist, Linnæus; and appears, by the journal of his tour to Lapland, to have been chosen by himself to commemorate his own name, when he gathered it at Lyksele, May 29, 1732. Former botanists had called this elegant and singular little plant *Campánula serpyllifolia*; but Linnæus, prosecuting the study of vegetables on the only certain principles, the structure of their parts of fructification, soon found this to constitute a new genus. He reserved the idea in his own mind till his discoveries and publications had entitled him to botanical commemoration; and his friend Gronovius, in due time, undertook to make this genus known to the world. It was published by Linnæus himself, in the *Genera Plantarum*, in 1737, and the same year in the *Flora Lapponica*, with a plate; being, moreover, mentioned in the *Critica Botanica*, as 'a humble, despised, and neglected Lapland plant, flowering at an early age,' like the person whose name it bears."

XVIII. 2. THE FEVER ROOT. *TRIOSTEUM*. L.

A small genus, containing only four or five species of perennial herbs or low shrubs, found in North America and the mountains of Central Asia, with opposite leaves whose stems are somewhat united at base, and flowers on short stalks or sessile in the axils of the leaves. The lobes of the calyx are

long and slender, and form a permanent crown to the ripened fruit; the tubular corolla is a little longer than the calyx, and somewhat unequal; and the berry is leathery and has three cells, and three or five, elliptic, bony seeds.

THE FEVER ROOT. *T. perfoliatum*. L.

Figured in Bigelow's Medical Botany, I, Plate 9.

This is a hairy, coarse-looking plant, with upright, annual stems, from one to four feet high, proceeding from a large, horizontal, branched, perennial root. It is distinguished by its large, opposite leaves, the pairs crossing each other, and its brown, axillary, sessile blossoms, usually in clusters.

It is found in shady places, in rich, moist ground. The calyx is of five linear-lanceolate, sharp, brown segments, persistent upon the ovary. Ovary round, sessile, green, covered with brown, headed, glandular hairs, with a thread-like bract on each side. Corolla of a dull, brownish purple, swelling at base, contracted just above, expanding towards the border, which is divided into five rounded, incurved, unequal segments. Stamens five, attached to the lobe of the corolla, hairy, yellowish white, with brown anthers. Style as long as the corolla; hairy, bearing a headed or shield-like stigma. Leaves two to six inches long and one to three broad, opposite, connate, in pairs, crossing each other, broad ovate, lanceolate, acuminate, entire, contracted towards the base, as if the petiole were winged, rough, veined, often waving, somewhat hairy above, velvety, pubescent beneath. Stem rough, hollow throughout. It flowers in June, and its orange berries are ripe in September.

The fever root has long had reputation for its medicinal virtues. The root, in the form of powder, or as an extract, has pretty regular effect as an emetic and cathartic. But, to be sure of its virtues, the practitioner must have it renewed every year, as it is thought to lose its efficacy from age. The stem and leaves seem to have much less active properties. The whole plant is bitter, and, in small doses, has a tonic effect.

XVIII. 3. THE HONEYSUCKLE. *LONICERA*. L.

A genus of climbing or erect shrubs with opposite branches, and leaves entire, opposite, and often growing together at base. The flowers, which are often fragrant, are in sessile whorls or heads, or on footstalks, in the axils of the leaves. The species are divided by De Candolle into two sections.

The first section embraces climbing plants with sessile flowers in whorled clusters or heads, and with leaves often connate; the berries crowned with the persistent limb of the calyx, forming the genus *Caprifolium* of Jussieu.

Among these are the splendid SCARLET HONEYSUCKLE or TRUMPET HONEYSUCKLE, which has been very generally introduced and found almost perfectly hardy, although it is a native of the Southern States, and not found naturally growing north of New York, and ten other species, according to Torrey and Gray, natives of North America, of which the following belong to Massachusetts.

Sp. 1. THE HAIRY HONEYSUCKLE. *L. hirsuta*. Eaton.

A perfectly hardy, climbing plant, found on damp, rocky banks, often growing to the height of fifteen or even thirty feet. Recent shoots reddish green, somewhat downy, or often nearly smooth. Branches reddish. Leaves on short, broad footstalks, which, in the upper leaves, are winged, and embracing the stem. The leaves are large, very broad-lanceolate or elliptic, or obovate, the upper ones pointed, the lower entire, rounded, sometimes rugose, from impressed veins above, ciliate on the reflexed margin, glaucous and soft, downy and hairy beneath. The upper pair completely grow together at base, like the upper leaves in other honeysuckles. They terminate in an abruptly prolonged point, and are ciliate on the margin, and hairy on the mid-rib beneath; but in surface and texture are so entirely unlike the other leaves, that they are more properly considered as connate bracts. The flowers are in single or triple terminal heads, made of from one to three or more whorls, on short footstalks; each whorl consists of about six sessile flowers. Calyx of five

minute, angular teeth. Corolla a tube, gibbous on the outer side at base, contracted above, and expanding with two tips, the outer one of a single oblong, reflected lobe, the inner of four, rounded and slightly reflected at the extremity. The flowers, covered with a glandular pubescence, are of a pale yellow without, and hairy and of a rich orange within. The inner surface and the filaments below, hairy. Stamens a little longer than the corolla; style ending in a round, flattened, green stigma. Berries orange. Found in the western parts of the State and in Sudbury. Flowers in June and July.

Sp. 2. THE SMALL-FLOWERED YELLOW HONEYSUCKLE. *L. parviflora*. Lamarek.

Stem light grayish. Recent shoots light glaucous, or greenish gray, with slightly projecting ridges. Leaves very glaucous, almost white beneath, and often with an undulate margin, giving them an appearance, at a little distance, of being armed with spines like the holly. Corolla yellow, tinged with purple. Berries orange. This is often an erect plant, of three or four feet, with no great beauty. It is perfectly hardy, as it is found growing abundantly in the western parts of the State. Flowers in June.

To the first section also belong the Woodbine or Common Honeysuckle, *L. perichlymenum*, a native of Europe, very generally introduced into this country; and the Goat's Leaf Honeysuckle, *L. caprifolium*.

The Yellow Honeysuckle, *L. flava*, a native of the Southern States, has long been cultivated in Europe, and has thence been introduced here. It is valuable for its agreeable fragrance and the splendor of its large, yellow flowers. Still more desirable is the Evergreen Honeysuckle. This most beautiful of the American honeysuckles, is not found wild, so far as I know, in Massachusetts; but as it is perfectly hardy, and more adapted to ornament gardens and front doors than either of the others, it ought to be introduced to universal notice.

The flowers are trumpet-shaped, the tube contracted in the middle, somewhat gibbous outwardly at base, enlarging upwards and opening with five reflected lobes, the outer one some-

what larger and separate. It is of a rich scarlet without, tinged with orange within, and on the stamens, which are slightly projecting. The flowers are terminal and in rather distant whorls, on long footstalks.

The uppermost or two uppermost pairs of leaves are connate, forming a round or oblong leaf, through the centre of which passes the stem. The next leaves are four or five inches long and two or three broad. The lower ones much more narrow but often longer. They are ovate-oblong, or elliptic, smooth, glaucous beneath. Recent shoots green. Stem gray, rough, the bark separating in long, fibrous scales.

The plant grows rapidly, throws out a multitude of branches, and has a singularly rich appearance, from the deep green of its leaves and the splendor of its scarlet flowers.

The second section includes erect or climbing plants, with flowers in the axils of the leaves; berries in pairs, distinct or united, not crowned with the limb of the calyx, and with leaves which are never connate; *Xylöstemum* of Jussieu. The most beautiful and fragrant of this division is the Chinese or Japan Honeysuckle, *L. Chinensis*, not generally introduced, but as well deserving to be cultivated as any species whatever.

Four species are found in North America, two of them in Massachusetts. Both have two minute bracts at the summit of the flower-stalk.

Sp. 1. THE FLY HONEYSUCKLE. *L. ciliata*. Muhlenberg.

A shrub five or six feet high, with a few straggling branches, growing among rocks and in wet places in Essex woods. The stem is round, slightly ridged by a line running down from the base of each of the branches, giving it an angular appearance. Bark striated, roughish, of a grayish ash color, clouded with brown. Branches opposite, forming a large angle. Leaves opposite, on very short, somewhat hairy stalks, broad ovate, or lanceolate, sometimes heart-shaped, entire, pointed, of a soft green above, paler beneath, substance soft and leathery. Wood soft, greenish white, very tough when young. Pith white, abundant, in small stems, occupying nearly half the diameter.

Flowers in pairs. The corolla is of a pale greenish yellow, with a slight projection on one side of the tube. Berries in pairs, diverging, egg-shaped, red, one fourth of an inch long. The flowers are in twos, on a long footstalk, with two, slender, short, thread-like bracts at the base of each.

Sp. 2. THE HAIRY FLY HONEYSUCKLE. *L. cærùlea*. L.

A rough looking bush, from one to four feet high, with crowded, opposite, diverging branches, growing in bogs in the western part of the State. The leaves come out with the flowers. The flowers are on short stems, with long, slender bracts at the base of the calyx. From one calyx proceed two yellow corollas, bulging considerably outwards at the base of the tube, which ends in oblong, erect lobes. The leaves are oval or oblong, rough on both surfaces when young, but becoming smooth above when old. The berries, which are made up of two united ovaries, are blue, covered with a glaucous bloom.

XVIII. 4. THE BUSH HONEYSUCKLE. *DIERVILLA*.
Tournefort.

A genus of three or four species of erect shrubs, indigenous to North America and Japan, with opposite, ovate, acuminate, sharply serrate leaves, on short stems, with axillary flowers, two, three, or four on a stem, with two bracts at base. The calyx-tube is cylindrical, and contracted at the summit; the ovary is two-celled, crowned with a fleshy disk, which fills the throat of the calyx; the fruit a crustaceous or leathery capsule, with two cells, two valves, and many seeds.

THE THREE-FLOWERED BUSH HONEYSUCKLE. *D. trifida*. Mænench.

A bush from two to four feet high, with a root somewhat creeping and horizontal, throwing up erect shoots. A projecting ridge running down at equal distances on the four sides of the stem, gives it a somewhat four-sided appearance. The recent shoots are green or reddish green, with the projection very conspicuous between the leaves. The stem is gray. The leaves are opposite, on short footstalks, ovate or oblong-ovate, rounded or acute

at base, beautifully tapering, acuminate, and serrate, smooth above, slightly fringed with bent hairs on the margin, and sometimes a little hairy on the veins beneath. The flowers, which are yellow, are terminal, or in the axils of the upper leaves; usually three on a stalk, of which the middle one is commonly sessile. The seed-vessel is very long, egg-shaped, with a long, taper point, crowned with the awl-shaped segments of the calyx. A variety occurs with the leaves narrower and thicker, much smaller, and constantly acute at base.

FAMILY XIX. THE ELDER FAMILY. *VIBURNEÆ*. BARTLING.

Closely allied to the Honeysuckle Family, with which it has, until recently, been united, this small family, embracing about eighty species, found, generally, in the temperate regions of the northern hemisphere, is strikingly distinguished by its habit and mode of flowering. Many of the species have beautiful flowers and foliage, and are favorites in ornamental gardens. The snow-ball, so great a favorite in many countries of Europe and in this, is a sterile variety of *Viburnum opulus*. The fruits are, generally, acid or astringent, sometimes purgative. The sweet flowers of the common elder, both of Europe and of this country, are sudorific, and the European species has been used as such from ancient times. They are packed in casks, by the French, with fruit, to give it an agreeable odor. Elder-berry rob, and wine, have long enjoyed, in England, an apparently well deserved reputation. The leaves and inner bark of these same elders are offensive, and have emetic and particularly purgative qualities in a powerful degree. The fruit of some species of *Viburnum* are austere and astringent; of others, not unpleasant to the taste, and capable of forming an article of food. The Wayfaring Tree, the Guelder Rose, and the Laurus-tinus, all species of *Viburnum*, are ancient favorites in England and other parts of Europe; the latter for the precious property of flowering, in warm countries, through the winter.

The plants of this family are shrubs or small trees, with apparently articulated branches and young stems containing pith of extraordinary thickness and durability; simple or compound, opposite leaves; perfect and regular flowers in broad, terminal cymes; a five-cleft, persistent calyx, adhering almost throughout to the ovary; a five-lobed bell- or wheel-shaped corolla, with lobes alternate with the parts of the calyx; five stamens inserted in the tube of the corolla and alternate with its lobes; an ovary with one, three, or five cells, and an ovule in each; and a fruit, which is a pulpy or fleshy drupe, with one or three, one-celled, one-seeded nuts.

Two genera, the Elder and *Viburnum* are found here, flowering shrubs or low trees, very widely diffused in distant regions of the northern temperate zone; and, in New England, the conspicuous ornaments of the borders of fields and woods and the sides of enclosures, in the early part of summer.

The Elder has compound leaves and a pulpy fruit with three nuts; the *Viburnum* has simple leaves and a fleshy fruit with one nut.

XIX. 1. THE ELDER. *SAMBUCUS*. Tournefort.

A genus of about twenty species of shrubs or perennial herbs, with a penetrating odor. Leaves opposite, pinnate, with the leaflets serrate, cut or lacinate, with two stipules or glands at the base of each. Flowers white or somewhat flesh-colored, usually fragrant, in compound cymes. There are two species in this State.

Sp. 1. THE PANICLED ELDER. *S. pùbens*. Michaux.

This is usually a coarse-looking bush, four to six feet high, with a large, whitish stalk, becoming brown when old, dotted with rusty, oblong dots, which enlarge and give a rough and warty appearance to the older and darker part of the stem.

The leaves are opposite, on large, round, fleshy footstalks, channelled above. The leaflets are five or seven, ovate-lance-shaped, rounded or acute, sometimes heart-shaped at base,

tapering to a long point, serrate, of a dull, dark green above whitish pubescent beneath.

The common flower-stalk is stout, long, and channelled, bearing a cyme of several pairs of alternating opposite, horizontal stalks, repeatedly dividing by twos or threes, at as large an angle as possible, so as to form a pyramidal head or thyrsus, two or three inches long. At the fifth division, are the flowers in pairs or threes, on short stems. The fruit, which is ripe in June and July, is a round, scarlet berry, surmounted by the three stigmas and the five obtuse segments of the calyx, and containing a yellowish, unpleasantly tasted, liquid pulp, and three stones or nuts. The variety with seven leaflets, more uncommon, has its leaflets nearly sessile, and is usually a much taller plant.

Drs. Torrey and Gray mention a variety found in the Catskill Mountains, with white berries. They have sometimes found the plant a small tree, eighteen feet high. The common variety is found in Worcester County, in the towns on every side of the Wachusett Mountain.

Sp. 2. THE COMMON ELDER. *S. Canadensis*. L.

Found in every part of the State and throughout Canada and the United States. It is a shrub, eight to ten feet high, growing in wet ground, and conspicuous in June and July for its broad cymes of white flowers. The leaf-stalks, flower-stalks and leaves are much smaller than in the preceding species. The stem is covered with a grayish bark, marked with prominent dots of the same color. Recent shoots smooth and green.

Leaves opposite, compound, with a smooth stalk, channelled above. Leaflets from five to eleven, on short stalks, oblong, ovate or obovate or elliptic, round at base, tapering to a long, acute point, serrate with large, hooked serratures, paler beneath, nearly smooth on both surfaces, when the fruit is mature, downy beneath when young.

Flowers white, in broad cymes five to seven inches across, on long, channelled, tapering stalks, divided and subdivided by

fives. Pedicel a slender, white thread, ending in a short calyx with five acute segments. Corolla a very short tube with five ovate, rounded divisions. Stamens five, short, attached to the corolla and alternating with its segments. Stigmas five, brown, sessile, on a conical ovary. The lower leaflets have often one or two leaf-like appendages. The berries are small, dark purple, or nearly black, when ripe, with crimson juice. This plant has a near resemblance to the Common Elder of Europe, *S. nigra*, except that the latter is a tree of twenty or thirty feet in height. Sir J. E. Smith said of this, that the English "uncertain summer is established by the time the elder is in full flower, and is entirely gone when its berries are ripe." The same might be said with equal truth of our elder, which, like that, flowers in June and ripens its fruit in September; unless we take into consideration that transient return of soft weather and sunshine, called the Indian summer. Much use has always been made, in every part of Europe, of the medicinal and economical virtues of their elder. The same may be made of ours. An infusion of the juice of the berry is a delicate test for acids and alkalis.* An infusion of the bruised leaves is used by gardeners to expel insects from vines. A wholesome, sudorific tea is made of the flowers. The unopened flower-buds form, when pickled, an excellent substitute for capers. The abundant pith is the best substance for the pith-balls used in electrical experiments; and the hollow shoots are in great use with boys for pop-guns and fifes.

XIX. 2. THE GUELDER ROSE. *VIBURNUM*. L.

A genus of more than fifty species of shrubs or small trees, with opposite branches, often more or less distinctly angular; opposite, undivided, or lobed leaves, with footstalks; and white flowers in terminal cymes, those of the margin sometimes sterile and with the corolla much enlarged.

* See Annals of the Lyceum of New York, p. 42.

SECTION FIRST.—*Flowers all similar and fertile.*Sp. 1. THE NAKED VIBURNUM. WITHE ROD. *V. nudum.* L.

A slender, erect shrub, from six to twelve feet high, growing in swamps and wet woods from Newfoundland to Georgia. The recent shoots are dark green, with numerous minute, rust-colored scales. The older stems are covered with a light ash-colored bark. The fruit-stalks, leaf-stalks, under surface of the leaves, and the mid-rib somewhat above, are sprinkled with brown, rusty dots, or scales. The leaves are opposite, two or three inches long, very variable in width, on short, flattened petioles which nearly or quite embrace the smaller branches, varying from broad-lanceolate to oval-elliptic, obovate and sometimes rhomboidal, the extreme ones more or less attenuated at both extremities, the lower ones obtuse at each end, entire, obsoletely serrate or crenate, coriaceous, smooth and shining above, beneath dotted with rusty brown scales. Foot-stalks rather long, channelled, and slightly winged.

The flowers are white, or yellowish white, in terminal cymes, on a footstalk half an inch to two inches long. The branches, radiating from a single point, are flattened, channelled and angular, and much sub-divided, with linear, fugacious bracts at the base of the pedicels. Flowers crowded; the calyx ending in five, thin, membranous, white, obtuse teeth; the corolla small, cup-shaped, with obtuse segments. Filaments very long; anthers small, yellow. The flowers expand in May and June.

The fruit is apple-shaped, compressed, with the minute calyx in the terminal cavity, one quarter of an inch long, of a deep blue color, and with a glaucous bloom; it is ripe in September. It has a sweetish taste and may be eaten. The stone is flattish, with an obtuse point, slightly hollowed on one side and convex on the other. The slender, tough rods of the previous year are much used, in some parts of the country, to bind sheaves.

Sp. 2. THE SWEET VIBURNUM. *V. lentago.* L.

A beautiful, small tree, rising sometimes to the height of fifteen or twenty feet, with rich foliage, and clothed, in June, with

a profusion of delicate, showy flowers. The branches and recent shoots are of a grayish brown, dotted, and often with a scaly or dusty surface. The smaller stems and larger branches are of a dark purple, almost black. The branches are opposite, at large angles. The leaves are broad oval, or lance-ovate, acute, rounded or sometimes heart-shaped at base, acuminate, sharply serrate, smooth above, paler or ferruginous beneath; the footstalk is rather long, channelled above, conspicuously margined with an irregular, waved or glandular border. The leaf-stalk, fruit-stalk, under surface of the leaf and the mid-rib above are set with ferruginous, glandular dots or scales. The leaves are often half bent backwards.

The flowers are in terminal cymes, sessile in the axil of a pair of leaves or branches. Five or more stalks spring nearly from one centre, and diverging an inch or more, divide repeatedly into three or more shorter branches, at the base of which is often visible a minute linear bract. The pedicels are very short, terminating in a round ovary, surmounted by a calyx of five minute segments, above which rests a salver-shaped corolla of one petal, expanding with five oval, rounded, reflexed segments of pure white. From the angles of these segments rise the five stamens, with slender, tapering filaments, longer than the corolla, and bearing on their point a short, yellow anther.

The great number of the anthers, in a head of flowers, gives a yellow tinge to the whole, and a very agreeable fragrance is diffused; amidst the flowers are often seen the leaves rising. The fruit is large, often half an inch or more long, on stout stems, oblong, flattened, and, when ripe in October, turns from a rich scarlet to a shining blue black, covered with a glaucous bloom and crowned with the permanent calyx-segments, surrounding the stigma. It is not unpleasant to the taste. The nut is oblong-oval, flattened, with an obtuse point, and grooved on both sides. The sweet viburnum is found from Canada to the mountains of Carolina and Georgia.

There is a softness and richness about the flowers and foliage of the sweet viburnum, which distinguish it above all others of the same genus.

It is hardly less beautiful in fruit, from the profusion of the

rich blue berries hanging down among the curled leaves, which are beginning to assume the beautiful hues of autumn. A tree of this kind makes a fine appearance at the angle of a walk, or in the corner of a garden, as its delicacy invites a near approach and rewards examination. With this delicacy of appearance, it is a hardy plant, and may, sometimes, be seen on a bleak hill-side, where it has encountered the northwest, stormy winds, for a score of years.

Sp. 3. THE ARROW WOOD. *V. dentatum*. L.

An erect shrub or small tree, four to fifteen feet high, growing in every part of the State, and from Canada to Louisiana, in swamps and wet grounds, remarkable for the yellowish green color and the large teeth of the leaves. The old stems are nearly black, and, from the damp places in which the plant grows, are often covered with thin, whitish lichens. The recent shoots are yellowish green, smooth and obscurely four-angled, with a few brownish dots. The stem in young plants is grayish purple above, darker below. The branches are opposite, at rather sharp angles. The leaves are opposite, often reflexed, on reddish green, channelled footstalks, which are half an inch or an inch in length. They are broad-ovate, or inversely egg-shaped, on the flowering branches nearly orbicular, on the growing shoots much longer, rounded or heart-shaped at base, pointed or acuminate at the extremity, conspicuously toothed, the teeth ending in a rather blunt point, yellowish green and shining above, lighter beneath, with strongly prominent veins, downy at the axils. In October, they become of a dark crimson.

The flowers are white, in terminal cymes, nearly flat above, on grooved, obscurely four-angled footstalks, enlarging upwards, and two or three inches long; from three to seven, angled, light yellowish-green branches, radiating from a common point on the central stalk, and afterwards branching somewhat irregularly. The ultimate flower stalk very short. Calyx ending in minute, white teeth. Corolla in one piece of five, expanding, rounded petals, with erect or diverging stamens at the angles within. Styles short, white. The fruit is of a dark lead color, when ripe, roundish-oval, crowned by the five brown, crushed

teeth of the calyx, surrounding the triple or apparently single stigma.

The young shoots of this tree are said by Marshall, (*Arbutum*, p. 160,) to have been generally used by the natives for arrows, whence it is known by the name of arrow wood.

Sp. 4. THE MAPLE LEAVED ARROW WOOD. *V. àccerifòlium*. L.

A slender, low shrub, not often more than five or six feet high, remarkable for the resemblance of its leaves to those of the red maple. It is found in rocky woods throughout the State, and from Canada to the country beyond the Mississippi. The stem is erect, with a brownish bark, and very infrequent wart-like, whitish dots. Recent shoots of a lighter brown or pale green, and with the leaf-stalks and flower-stalks downy and scattered with hairs. Branches opposite, ascending at a sharp angle. Leaves opposite, from two to four inches long, and of nearly equal breadth, rounded or heart-shaped at base, three-lobed, with large, irregular teeth, waved, smooth or somewhat hairy, and impressed at the veins above; lighter and downy, and hairy, particularly on the veins and veinlets beneath; the lobes diverging, separated by a broad, shallow notch, and ending in a prolonged, often bluntish point. The leaf-stalks appressed and swelling at base, round, one inch or less in length, with scattered hairs and somewhat downy, and with colored, linear, pointed stipules at base, or assuming the form of glands higher up. The terminal leaves are often entire, without lobes, and broad-ovate or roundish in shape.

The flowers are in terminal cymes, on round, smooth, or slightly pubescent stalks, gradually enlarging, and about two inches long, with two linear, perishing bracts at the end. The partial footstalks, about six in number, radiate from one point, and repeatedly and somewhat regularly sub-dividing by threes or twos, terminate in pairs of very short flower-stems. The flowers are tinted with pale purple before opening. The calyx ends in five small, obtuse, appressed, colored teeth. The corolla is white, cup-shaped, with five ovate, pointed or rounded, reflexed segments. Stamens on tapering filaments, twice as long as the corolla, bearing a large, short, yellow anther. The ber-

ries are oval, a third of an inch long, pointed, compressed, oval, blue-black when ripe, and very disagreeable to the taste. The nut is of the same shape, slightly grooved.

SECTION SECOND.—*The flowers in the margin of the cymes much larger than the others and sterile.*

Sp. 1. THE HIGH CRANBERRY. CRANBERRY TREE. *V. ópulus*. L.

A handsome, low tree, five to ten feet high, ornamented throughout the year with flowers or fruit. In May or early in June, it spreads open, at the end of every branch, a broad cyme of soft, delicate flowers, surrounded by an irregular circle of snow-white stars, scattered, apparently, for show. From the common axil of the upper pair of leaves, a stout, furrowed footstalk, one or two inches long, separates into five, six, or more, radiating branches, from each of which, after successive similar sub-divisions, proceed a number of crowded flowers, diverging, on short, partial footstalks, from a single, central point. Each perfect flower is a white cup of a single piece, with a border of five round lobes, sitting in a green calyx with a few obsolete teeth, and bearing, from its base, within, five upright stamens, twice as long as itself, which support whitish anthers, opening from the top. The germ is a short, white, conical body, terminating in two or three minute stigmas, and seeming, when the corolla is gone, immediately to surmount the calyx. At the base of the flower-stems and branches, are long, linear, brown, fugacious bracts. The outer florets are on longer stalks, barren, salver-shaped, of five larger, unequal, obovate, rounded lobes.

The leaves are opposite, from two to five inches long, straight, rounded or acute at base, three-nerved, and with three very divergent, acuminate lobes, and large, unequal, obtuse teeth, strongly veined, paler beneath. The footstalks are three fourths of an inch to an inch in length, with one or two glandular stipules below, and a few glands near the base of the leaf and towards the bottom, the lower ones hair-like.

The fruit, which is red when ripe, is of a pleasant acid taste, resembling cranberries, for which it is sometimes substituted.

Drs. Torrey and Gray have shown that there is no essential difference between this plant and the European *Guelder Rose*, *V. ópulus*, a variety of which, propagated by gardeners, is the well-known *Snow Ball Tree*.

Sp. 2. THE WAYFARING TREE. HOBBLE BUSH. *V. lantanòides*. Michaux.

Figured in Audubon's Birds, II, Plate 148.

This plant received its specific name, *lantanòides*, from its resemblance to the English Wayfaring tree, *V. lantàna*, the tree which William Howitt addresses, when he says,—

“Wayfaring tree! what ancient claim
Hast thou to that right pleasant name?

* * * * *

Whate'er it be, I love it well;
A name, methinks, that surely fell
From poet, in some evening dell,

Wandering with fancies sweet.”—*Book of the Seasons*, p. 115.

That tree rises to the height of eighteen or twenty feet, and has an ample head of white flowers. Ours, less fortunate in its name, is a stout, low bush, found in dark, rocky woods, and making a show, in such solitary places, of a broad head of flowers, the marginal ones often an inch across. It has large, opposite, very diverging branches, often declining to the ground, and a dark brown bark, scattered with a few grayish, wart-like dots. The recent shoots, flower-stalks and leaf-stalks are profusely clothed with a brown, rusty down, which gradually disappears from the branches, except towards the joints.

The buds come out in threes, of which the middle one often contains flowers and leaves, the side ones leaves only. They have no scales, but are, instead, clothed with a close, rusty tomentum, which gives them the appearance of leather. The leaves are from four to six inches in length and breadth. The leaf-stalks have an appendage at base, which, though gradually shrivelling, is very large at first, forming a broad wing near the base, and terminating in awl-shaped points.

The leaves are roundish, heart-shaped at base, ending in a short, abrupt point, and unequally serrate on the margin. They

are nearly smooth above, but beneath, downy on the veins, which are thereby rendered strikingly distinct. The primary veins, which are prominent, branch only on the lower side, and are intersected at right angles by the parallel secondary veins, forming a beautiful net-work.

The cymes or heads of flowers radiate from two or more points, the partial footstalks having at their base, linear or strap-shaped, leathery, deciduous bracts. The fruit is ovate, large, of bright crimson color, turning afterwards almost black. The minute calyx occupies the terminal cavity. The nut is oblong-oval, with an obtuse point, flattened, and grooved on both sides.

FAMILY XX. THE HEATH FAMILY. *ERICA'CEÆ*.

Few families embrace a greater variety of extremely beautiful plants than this. Few are so universally the favorite objects of cultivation. They recommend themselves to the cultivator by their hardiness, many of them being natives of this or of similar climates, by their showy and lasting flowers, and often by their evergreen leaves. There are three, very distinct sub-divisions of the family; the Heaths, the Rhododendrons, and the Andromedas. The Pyrolas and Monotropas, still more distinct, are by some authors considered as forming a separate family. Of the true heaths, we have no native species. The greater part of them are indigenous to the Cape of Good Hope, whence they have been most extensively introduced into the conservatories of Europe and America; a few are natives of Europe. Of the other allied tribes we have many representatives in New England. Distinguished by their singular beauty, peculiar appearance, and usually their social or gregarious habits, they are found in all climates and in almost all parts of the world, except New Holland, in which their place is taken by their near allies, the Epacrideæ.

The plants of this family are shrubs, under shrubs, or trees, with leaves mostly entire, coriaceous and sempervirent, without

stipules. The flowers are usually perfect, symmetrical and regular. The calyx is usually four- or five-cleft; the corolla four-parted, rarely five-parted, with the parts alternate with those of the calyx; the stamens are as many as the segments of the corolla and alternate with them, or twice as many, inserted in the base of the corolla, or in the edge of a disk at the bottom of the calyx; anthers two-celled, opening by a terminal pore or cleft, and with often a pointed bristle projecting above or below. The ovary is free, with cells as numerous as the segments of the calyx and alternate with them, and many-seeded; or rarely one-celled. The fruit is capsular, or rarely berry-like, and generally many-celled and many-seeded.

In their properties, they are almost universally more or less astringent and diuretic, and many of them abound in tannin. But the different tribes have different properties. The heaths of the north of Europe are used by the inhabitants to tan leather, to dye yarn, as an ingredient in beer, and as a material for thatching; and the seeds afford food to many kinds of birds. Most of the plants of the *Rhododendron* group are of a doubtful character, and to some animals several of them are poisonous. The fleshy berries of some of the *Andromeda* group are an agreeable and healthy article of food. Honey made by bees that feed on the flowers of the European heaths is said to be of an inferior quality, and that from bees fed on some species of *rhododendron* is considered poisonous. The pleasantly acidulous berries of the Strawberry Tree, *Arbutus unedo*, are eaten in the south of Europe, and in Corsica an agreeable wine is prepared from them. Its bark is very astringent, and, in Spain and the East, is employed in tanning.

THE ANDROMEDA TRIBE. *ANDROMEDEÆ*. DON.

Shrubs with a capsular fruit and deciduous corolla.

XX. 1. THE ANDROMEDA. *ANDROMEDA*. L.

Humble shrubs, found in North America and also in northern Asia and Europe; with a five-cleft calyx, with acute segments, simple at base; a globose corolla with a contracted mouth; and ten included anthers with bearded filaments, and short, one-awned anthers.

THE WATER ANDROMEDA. *A. polifolia*. L.

It was for this modest and delicate plant, which is a native of the north of Europe as well as of this country, that Linnæus selected the poetical name of the genus. The following is the account which himself gives of it in his "Tour in Lapland," I, 188. "Andrómeda polifolia was now (June 12,) in its highest beauty, decorating the marshy grounds in a most agreeable manner. The flowers are quite blood-red before they expand; but, when full grown, the corolla is of a flesh-color. Scarcely any painter's art can so happily imitate the beauty of a fine female complexion; still less could any artificial color upon the face itself bear a comparison with this lovely blossom. As I contemplated it, I could not help thinking of Andromeda, as described by the poets; and the more I meditated upon their descriptions, the more applicable they seemed to the little plant before me; so that, if these writers had it in view, they could scarcely have contrived a more apposite fable. Andromeda is represented by them as a virgin of most exquisite and unrivalled charms; but these charms remain in perfection only so long as she retains her virgin purity, which is also applicable to the plant now preparing to celebrate its nuptials. This plant is always fixed on some little turfey hillock in the midst of the swamps, as Andromeda herself was chained to a rock in the sea, which bathed her feet, as the fresh water does the roots of this plant. Dragons and venomous serpents surrounded her, as toads and other reptiles frequent the abode of her vegetable ressembler, and, when they pair in the spring, throw mud and water over its leaves and branches. As the distressed virgin cast down her blushing face through excessive affliction, so does this rosy-colored flower hang its head, growing paler and paler till it withers away." "At length, comes Perseus, in the shape of summer, dries up the surrounding water, and destroys the monsters, rendering the damsel a fruitful mother, who then carries her head (the capsule) erect."

This, as it is found here, is a low shrub, a foot or more in height, growing naturally in boggy places, but capable of being successfully cultivated in any common, moist soil. The stem

is clothed with a grayish bark, with a few short leafy branches near the top, and with umbels of drooping, snow-white or flesh-colored flowers at or near the end. The branches are slender, and covered with a pearly, sometimes reddish bark. The leaves are on short petioles, narrow, lanceolate, much revolute at the edges, pointed, glossy green above, of a pure glaucous or whitish color beneath. The short, pearl-white flower-stems spring from the bosom of ovate, concave, pointed bracts of the same color. The short, acute, persistent segments of the calyx are white, tipped with red. The corolla is five-angled, nearly globular, almost closing at the mouth, with the obtuse segments revolute. A faint, rosy tinge is often spread over the whole flower. The stamens are very short, with brown anthers, which open in two terminal pores, and are tipped with short, awl-like bristles. The round ovary terminates in a club-shaped stigma. Flowers in June. It is found on the edge of Richards' Pond, in Brookline; on tussocks in a bog in Richmond, and elsewhere. This plant, like others of its kind, may be propagated by dividing the root or by layers.

Several other species, which had been included in the genus *Andromeda*, have been elevated by Don into new genera; *A. calyculàta* to *Cassandra*; *A. paniculàta* to *Lyonia*; and *A. racemosa* to *Zenobia*. Their great difference in habit and appearance seems to authorize a change made on botanical grounds.

XX. 2. THE CASSANDRA. *CASSANDRA*. Don.

A genus of two species of low shrubs, covered with a fine pubescence, which makes them look as if sprinkled with dust. The leaves are leathery and persistent; flowers white. The calyx is five-leaved, with two bracts at base; the corolla oblong, enclosing ten stamens, with anthers which terminate in tubes. Both species are cultivated in Europe for their beauty.

THE DWARF CASSANDRA. *C. calyculàta*. D. Don.

A low, leafy, evergreen shrub, from two to five feet high. The bark on the principal stem and larger branches is very

smooth, and of a remarkably dark copper color. The recent shoots are covered with a close, brownish down, which is not entirely removed till the end of three or four years.

The leaves are alternate, on very short petioles, oblong-lanceolate, often larger towards the extremity, rather obtuse, obsolete serrate and somewhat revolute at the margin, shining above and dotted with scaly dots, which beneath are rust-colored.

The flowers are in racemes, on the ends of the branches, in the axil of last year's leaves. These leaves are much smaller than those not supporting flowers, and are formed later in the previous season. They diminish in size to the extremity of the branch, where they are only two or three lines long.

The flower-stalks are short and stout, and, at the time of fruit, are arranged in two rows. Just below the calyx are two very short, rounded, acuminate bracts. The segments of the calyx are five, pointed, with a membranous border, coriaceous, persistent, and protecting the fruit, and closely covered with white scales.

Corolla white, egg-shaped, somewhat five-sided, contracted towards the mouth, ending in five slightly reflexed, rounded, brownish teeth, between which the point of the pistil shows itself. Stamens ten, opening from the base of the corolla; filament ribbon-shaped, white below, gradually tapering to a brownish thread. Pistil persistent, tapering, gradually dying down to the capsule. Fruit a capsule, round, flattened, opening late by five valves, two-coated, the external, dark, coriaceous, the internal, whitish yellow, and remaining on the branches until the appearance of the flowers of the succeeding spring. Anthers brown, of two long, conical tubes, opening at the point. It forms large beds in the edge of swamps or boggy meadows, where it opens its abundant and showy racemes in April, among the earliest flowers of spring.

XX. 3. THE LYONIA. *LYONIA*. Nuttall.

A genus so named by Mr. Nuttall to commemorate the name of John Lyon, an indefatigable collector of North American plants, who fell victim to a dangerous epidemic, amidst those

savage and romantic mountains, which had so often been the theatre of his labors.—*Nuttall*, Genera I, 266.

It consists of a few North American shrubs, with entire or denticulate, membranous or downy leaves, and rose-colored or white flowers in lateral or terminal panicles: distinguished from the preceding by having the anthers opening lengthwise, and by their five-angled, five-celled capsules, with five valves having their margins closed by five other, external, narrow valves.

THE PANICLED LYONIA. *L. paniculata*. L.

A bushy shrub from three to eight feet high, conspicuous in the early part of summer for its long and crowded panicles of white flowers, and afterwards for its persistent, five-cleft seed-vessels. The root is strong and tough. Its stem and irregular branches are covered with a light pearly, ash-colored, stringy bark, which on the last year's shoots is reddish, and on the recent shoots light green, and often downy. The leaves are in bunches, or alternate, on short, appressed stalks, lance-shaped, elliptic or inversely egg-shaped, entire, or minutely serrate, acute or acuminate at each end, smooth above, lighter and downy beneath.

Flowers in an irregular, terminal, compound panicle, with small leaves at the base of the branches, and linear, brown, very fugacious bracts; partial footstalks, thread-like, downy. Calyx greenish, of five teeth, scarcely distinguishable by the eye from the corolla to which it closely adheres. Corolla white, nearly globose, with five minute, reflected teeth almost closing the orifice. Anthers with doubly curved filaments, bringing the anthers round the base of the pistil, which is nearly as long as the corolla.

Lyonia mariàna,—*Andrómeda mariàna* of our botanists, another beautiful plant, is found in Rhode Island, and probably will be in Massachusetts.

XX. 4. THE ZENOBIA. *ZENOBIA*. D. Don.

North American, evergreen shrubs, bearing racemed flowers, with a five-lobed calyx and bell-shaped corolla, with ten sta-

mens, whose anthers have long, tubular cells, ending in two awns.

THE CLUSTERED ZENOBIA. *Z. racemosa*. De Candolle.

A low shrub, four to six feet high, with irregular, straggling branches, much resembling the whortleberry bushes. Leaves on very short petioles, broad-lanceolate or oval, acute at each extremity, serrulate, of nearly the same color on both surfaces, somewhat downy on the veins beneath. Flowers in regular racemes, one to three, or four inches long, on the ends of the floral branches, and usually protected by the leaves; they are all turned downwards and have been likened to rows of teeth. Partial flower-stalk very short, with two small, colored bracts at base. Calyx of five lanceolate, pointed, greenish or brownish white segments, embracing the corolla, and, after that is fallen, closely adhering to the ovary.

Corolla oblong-cylindrical, contracted at the mouth, semi-transparent at the line of the segments, which are rounded and diverging or revolute at the extremity. Filaments dilated at base, short, white, tapering to a brown point, supporting the brown anthers, which are cleft, each division having two awns. Style exserted. The ovary becomes a dry, globular capsule, which opens in five recurved valves, surrounded by the persistent calyx and bracts, and remaining usually till the flowers of the next year appear.

This is a beautiful but much neglected plant. Few exotics have such elegance of appearance. Few are so little known. This, like the plants of the previous genera, may be easily cultivated. They require a peat soil or sandy loam. Don says of them, "Being very ornamental, they are desirable shrubs in every garden. They are propagated by layers or by seeds. The seeds should be sown in pots or in pans, in sandy peat soil; they should be covered slightly with earth, as they are extremely small."—*Gen. Sys.*, III, 831.

Oxydendrum arboreum, *Andròmeda arlòrea* of American botanists, is a handsome, small tree, belonging to this group, which might be easily introduced here, as it grows freely a little farther south.

XX. 5. THE CLETHRA. *CLETHRA*. L.

The name is the Greek word for the alder, which the plants of this genus resemble in their leaves. They are mostly American shrubs with alternate, deciduous leaves, and white, bract-eate flowers in axillary or terminal spikes. The calyx is five-parted, persistent; corolla so deeply five-parted as to appear five-petalled; stamens ten, with pointed anthers; capsule enclosed by the calyx, with three, many-seeded cells, which open in the middle.

THE ALDER LEAVED CLETHRA. *C. alnifolia*. L.

Poorly figured in Catesby's Carolina, I, 66.

A shrub from two to eight feet high, showing a long spike of white, fragrant flowers towards the end of summer, when most other shrubs have long cast their blossoms. It grows naturally and abundantly by slow streams, or in islets in deep bogs, where it can, at most seasons, bathe its feet in water.

The flower-stem is of a whitish green and downy, below which the shoot is of a faint reddish color, covered with a gray down. The stem at last becomes dark purple, striate with gray. The leaves are inversely egg-shaped, gradually tapering at base to a short, downy footstalk, pointed, and serrated with pointed serratures from below the middle to the extremity, smooth, downy on the mid-rib above, a little hairy on the mid-rib and primary veins beneath. Flowers in long racemes, terminal, or from the axils of the upper leaves. Cup of five short, hollow, ovate, pointed, white, downy segments, which are persistent, and, after the fall of the corolla, close round and protect the ovary. Petals apparently five, oblong, concave, rounded at the extremity, twice as long as the calyx, white with lines of green. Stamens ten, long, cylindrical, unequal. Anthers with two diverging lobes, pointed at the apex, opening by pores below, at length inverted, orange-brown. Ovary round, downy. Style as long as the stamens. Stigma three-parted. Capsule obtusely triangular, opening by the sides of the three cells, and containing many small angular seeds attached to the partitions.

This beautiful plant may be easily cultivated, and is much improved by cultivation, the spikes being increased in length and in the size of the flowers. It grows readily in any garden soil, and may be propagated by layers or cuttings.

There are several other species of clethra which might be introduced, especially the *acuminate*, the *panicled*, and the *downy*, which would doubtless flourish, as they are natives of the higher parts of the Southern States, and have been successfully cultivated in the open air in England. The first of these is a small tree. They all continue in flower from July to October.

XX. 6. THE GROUND LAUREL. *EPIGÆA*. L.

Creeping, tufted, roughish, evergreen, American under-shrubs, with alternate, entire leaves, and fragrant flowers in dense, axillary and terminal racemes. The calyx is deeply five-parted, with three bracts at the base; the corolla salver-shaped, villous within, with a five-parted, spreading border; stamens ten, with anthers opening inwards from top to bottom; capsule five-celled, many-seeded, encircled by the persistent calyx. There are two species, one found on mountain tops, in the Antilles, the other here.

THE MAY FLOWER. *E. repens*. L.

Often from beneath the edge of a snow-bank are seen rising the fragrant, pearly, white or rose-colored, crowded flowers of this earliest harbinger of the spring. It abounds in the edges of woods about Plymouth, as elsewhere, and must have been the first flower to salute the storm-beaten crew of the May Flower on the conclusion of their first terrible winter. Their descendants have thence piously derived the name, although its bloom is often passed before the coming in of the month of May.

The trailing stem runs along for several feet just beneath the covering of leaves on the surface of the ground, throwing out from the sides or joints, at distances of two or three inches, bunches of fibres or long fibrous roots, and ascending flower- and leaf-bearing shoots, which usually enlarge upwards. The extremities spread on the ground, brown, hairy and rough. The

flowers are in terminal, crowded, sessile clusters or corymbs. At the base of each partial footstalk is a whorl of three, concave, lanceolate, hairy, green bracts, ending in a long point. Just above is the calyx of five narrow, subulate segments, half as long as the tube of the corolla. The rose-colored or white pearly corolla is a long tube, very hairy within, the extremity expanding into five rounded lobes. On the throat appear the yellow anthers, opening from top to bottom, and resting upon slender filaments, hairy towards the base, proceeding from the bottom of the tube. Leaves alternate. Footstalks hairy, half as long as the leaves, channelled above. Leaves oblong, cordate, rounded at the extremity, and often mucronate, ciliate on the margin, coriaceous and evergreen, smooth and shiny above; veinlets impressed; shiny and somewhat hairy, especially on the mid-rib and veins beneath. Stigma headed, five-pointed; style straight; ovary ovate, hairy. The flower buds are formed in August.

The May flower is found as far north as the Saskatchewan, throughout Canada and Maine, and thence to the sand hills of Carolina and Georgia.

XX. 7. THE BOXBERRY. *GAULTHERIA*. L.

A genus named by Kalm, the favorite pupil of Linnæus, in honor of Gaulthier, a physician and botanist of Quebec in Canada. It contains, according to De Candolle, about forty species, the greater part of which are found in North and South America, especially in Mexico, some on the mountains of Central Asia and Java, three in New Zealand. They are shrubs and under shrubs, sometimes low trees, with alternate leaves, and axillary or terminal, often fragrant flowers, white, rose-colored, or scarlet. The calyx is five-cleft, with two bracts, distinct or united, beneath; corolla ovate, with a short, revolute, five-cleft border; stamens eight or ten, with hairy filaments, and anthers bi-lobed at top, each lobe two-awned; ten scales, distinct or united, in the bottom of the cup; capsule depressed, globose, five-furrowed, five-valved, five-celled, many-seeded, invested at base by the calyx, which sometimes becomes berry-like.

THE CHEQUER BERRY. PARTRIDGE BERRY. *G. procumbens*. L.

Figured in Bigelow's Medical Botany, Plate 22. Audubon's Birds, with the Wood Wren, II, Plate 179.

A delicate, fragrant, evergreen plant, growing in the deep shade of other evergreens, throwing up from a creeping root a tuft of three or four, sometimes seven or eight leaves, and nearly as many flowers. Stem an inch or two high, dotted with white dots, downy, with one or two linear, brown, abortive leaves near the surface of the ground.

Leaves elliptical or obovate, pointed at each extremity, or sometimes rounded at the end with a delicate, reflected, membranous border, and a few distant teeth or serratures ending often in a bristle. They are of a leathery texture and of a polished dark green above, lighter below, supported by a short, rather stout, often hairy petiole.

Flowers of a pearly white, solitary, from the axil of the leaves, on white or reddish, slender, hairy or downy footstalks, one third or one half an inch long. Calyx double; the exterior of two very short, broad, concave, pointed bracts, the interior ending in five or six triangular teeth. Corolla monopetalous, conical, broad at base, and gradually diminishing towards the top, where it suddenly contracts and terminates in five or six rounded teeth, nearly closing the orifice. Filaments very short, white or pink, hairy without. Anthers as long as the filaments, set upon their inner side, brown, large at base, divided half way down, each division terminated with two pointed bristles or awns. Style nearly as long as the corolla, uniform, surmounting a five-sided, or rounded, greenish ovary, which rests on a deep green disk with ten projecting teeth. The flower-stalks bend down, so that the flowers and fruit hide themselves under the leaves.

Flowers in May and also in the end of summer and in autumn; and the fruit is ripe in autumn and in spring. The berry is of a bright scarlet, pleasant to the taste, but rather insipid. It is often eaten in the spring when no other berry is to be found. Its importance to the partridges and other birds who

hibernate in our climate, gives it its most common name. It is also called Chequer Berry, Box Berry, Ivory Plum and Mountain Tea. The whole plant has a pleasant, aromatic flavor, similar to that of the black birch.

The leaves are sometimes employed as a substitute for tea, or added to communicate an agreeable flavor. An essence and an oil are extracted from the plant, which possess, in a high degree, the astringent, warming and tonic properties of the leaves. An infusion of the leaves has been successfully employed to restore the action of the breast, when that fountain had been dried up.

This plant is found from Quebec, in Canada, to the mountains of Carolina.

XX. 8. THE BEAR BERRY. *ARCTOSTAPHYLOS*.
Adanson.

A genus of twelve or thirteen species of low shrubs with alternate leaves, terminal, bracteate racemes of white or flesh-colored flowers, and red or black fruit, natives of North America, chiefly the mountains of Mexico, and rocky woods and sunny mountain tops of northern Europe and Asia. Calyx five-parted, persistent; corolla ovate-pitcher-shaped, with a short five-toothed, reflexed mouth. Stamens ten; filaments hairy, dilated at the base; anthers compressed, opening by two pores at the apex, with two reflexed awns on the sides; ovary depressed-globose, girt with three fleshy scales; style short; stigma obtuse; drupe globose, five-, six-, nine- or ten-celled; cells one-seeded.

THE COMMON BEAR BERRY. *A. uva ursi*. Sprengel.

Figured in Bigelow's Medical Botany, I, Plate 6.

A shrubby, evergreen plant, trailing upon the ground or on rocks, and forming large, close mats, on dry, sandy plains or rocky hills. Stem woody, with a grayish bark, which peels off in patches. Young shoots ascending, clothed with a brownish, downy bark. Leaves crowded towards the end of the branches, alternate, inversely egg-shaped, obtuse at the end, wedge-shaped at base, smooth on both surfaces, shining above,

paler and reticulate beneath, with a fringe of soft hairs on the margin, on a short, downy footstalk. Flowers drooping, in a terminal cluster. Flower-stem short, with a lance-shaped, persistent bract at base, and two short concave ones just above. Calyx of three to five, reddish, rounded segments, which remain and invest the base of the ripe fruit. Corolla pitcher-shaped, flesh-colored, pellucid at the base, hairy inside, with a contracted mouth of five short, reflexed segments. Anthers short, dark purple, opening with terminal pores, and tipped with two long, crimson, reflexed bristles; filaments thick at bottom, tapering, hairy. Stigma short, cylindrical. Ovary green, orbicular, resting on a flattened, purple torus.

Berries globular, of a deep red, filled with a tasteless, mealy pulp, and a drupe made up of five wedge-shaped nuts. They remain on through the year, and serve as food for partridges and grouse.

This plant abounds in the Alps and Pyrenees, and in all the northern and mountainous parts of Europe, as well as in this country. Every part of the plant is very astringent. In Sweden and Russia it is employed in great quantities in tanning, in the preparation of morocco, and sometimes for dyeing wool an ash color. In Iceland, according to Sir William Hooker, it is used to impart a deep brown, and a black color. "A deep brown dye is produced by boiling the cloth in water, with a quantity of the leaves of *sortilyng* or *Arbutus uva ursi*," (for six hours, in an iron pot.) To make it afterwards black, it is boiled with a paste of earth called *sorta*.* In medicine, it has been found efficacious in diseases affecting the urinary passages and in those of the kidneys.

THE RHODORA TRIBE. RHODOREÆ. (*Resembling Rhodora.*) DON.

This section contains many of the most showy and ornamental evergreen or deciduous plants known, and several of the most beautiful are natives to our climate. They are distinguished by having flat leaves with the mid-rib callous, and flower-buds with imbricated scales resembling the cones of pines.

* See Journal of a Tour in Iceland, p. 215 of the 2d ed.

XX. 9. THE ROSE BAY. *RHODODENDRON*. L.

Shrubs or trees, mostly evergreen, with alternate, very entire leaves, and showy, purple, lilac, rose-colored, white or yellow flowers, in terminal corymbs, growing naturally on the mountains of Europe and Asia, in North America, and on the continent and islands of India. Many of the species have been much cultivated for their beauty, and many curious and beautiful varieties have been formed by hybridizing. The Tree Rose Bay, *R. arboreum*, found on the mountains of Nepaul, at a height of not less than ten thousand feet above the sea, has natural varieties, with purple, intensely red, rose-colored, and white flowers. "They attain the size of very large forest trees, and are noble objects at all times. They blossom simultaneously in April, in which state the beauty of them surpasses all description, the ample crown of the trees being entirely covered with bunches of large and elegant blossoms."—*Wallich, Pl. As. Rar.* The flowers are eaten by the natives, and are formed into a jelly by Europeans. The Alpine Rose Bay, *R. ferrugineum*, which grows in the pasture-lands amongst the Alps and Appenines, has extremely beautiful flowers of lilac, inclining to rose-color, of a disagreeable odor. The leaves are considered poisonous, and a weak infusion of them acts powerfully as a sudorific. The Pontic Rose Bay, *R. Pónticum*, a native of Lebanon and the mountains of Asia Minor, has flowers of nearly the same color, the odor of which is considered by the inhabitants of the coast of the Black Sea as unwholesome, and the honey made by bees feeding on the flowers has, since the time of Xenophon, been considered poisonous, producing vertigo and nausea in those who eat it. Pallas denies that this property of the honey is owing to the effect of the flowers of the rose bay, and attributes it to the flowers of *Azàlea Póntica*, which, he says, grows plentifully among the bushes of rhododendron, and which is known to render honey deleterious. The Purple Rosé Bay, *R. puniceum*, so called from the color of the flowers, is a magnificent tree of the mountains of the north of India. Its leaves are often covered with a sugary substance, which hardens to the appear-

ance of varnish. The rose bay of Mount Caucasus has lilac-colored flowers; the Golden-flowered, *R. chrysanthum*, a low shrub with flowers of citron yellow with orange dots, is spread extensively in Russia and Siberia, where a decoction of its leaves is a celebrated remedy for rheumatism and affections of the skin. In small doses, it is sudorific; in large, poisonous. The Daourian and the Kantschatka rose bays, very low shrubs with rose-colored flowers, and the Chinese, *R. Indicum*, of purple, flesh-color, rose, white or yellow, are, with all those above-mentioned and some others, cultivated in Europe and in this country. The species indigenous to the United States are the American Purple, *R. purpureum*, the Catawba, the Dotted, *R. punctatum*, all which are much cultivated and highly prized; Pursh's, the Lapland,—and the American, *R. maximum*, one of the most beautiful, and the only true rhododendron found growing spontaneously in Massachusetts. The leaves of the Bell-flower Rose Bay, *R. campanulatum*, are used as snuff by the natives of India. The same use is made of the leaves of *R. maximum* in this country; and the snuff is considered efficacious in catarrhs and other affections of the head. The rhododendron has a five-parted calyx; a five-lobed (rarely seven-lobed) corolla which is funnel-shaped, bell-shaped, or rarely wheel-shaped, with the limb either equal or somewhat two-lipped, the upper lip being broadest and usually spotted. The stamens are five or ten, (rarely six to nine, or fourteen,) free from the corolla and commonly declined and projecting; with anthers opening by two oblique, terminal pores. The ovary has five or ten cells, with many ovules in each. The capsule is five-celled, five-valved, rarely ten-celled, ten-valved; the seeds numerous, compressed, winged, attached to the central axis.

THE COMMON AMERICAN ROSE BAY. DWARF ROSE BAY.

R. maximum. L.

Figured in Bigelow's Medical Botany, Plate 51; in Audubon's Birds, II, Plate 103; and in Michaux, Sylva, II, Plate 67.

The rose bay, as it occurs growing spontaneously in this State, is a low, spreading plant, with its lower branches lying

on the ground, and its central stems rising to the height of from three to six or seven feet. It forms round or straggling clumps or islets in the swamps where it is found. In more southern States, it sometimes rises to the height of twenty or twenty-five feet, with a diameter of four or five inches. The stem is grayish, and rough with loose, broken flakes of bark. The recent shoots are large, and, with the leaf-stalks, are yellow or of a yellowish green color, often covered with white dust. The older branches are dark purple and soon turn gray.

When the leaves first begin to expand, they are of a reddish color and covered with an abundant red down or cotton. When fully expanded, they are smooth, of a shining light, afterwards dark green above; when several years old, they become brown, coarse and rough. Their lower surface is pale or rust-colored. They are from three or four to eight or nine inches long, and one or two broad, elliptic-oblong, round, obtuse, or acute at base, with a very entire, slightly reflexed border, and ending in a rather sharp, entire point. Their texture is firm, tough and leathery, and they are supported on very stout footstalks, flattened or hollowed above, half an inch or an inch long.

The flowers are in round, thyrses-like, crowded clusters, from four to eight inches broad, on the ends of the branches. The large, conical, flower-buds are formed in September. Just before expanding they are one or two inches long, and an inch broad, invested with a large number of concave, rhomboidal, pointed, more or less colored scales, one of which protects each separate flower-bud, and among which the richly colored corolla is seen at intervals. As the flowers expand these scales fall off, leaving numerous scars at the base of the common flower-stem. Each flower is supported by a stalk one or two inches long, which, as well as the calyx leaves, is covered with a viscid or glutinous down, and has long, thread-like, downy bracts, on each side at the base. The calyx is divided into five unequal, rounded segments, of a delicate texture. The corolla is of one piece, with a border expanding from a short tube into five unequal, oblong, rounded segments, the upper one of which is largest and has its cavity mottled with numerous small, yellow or greenish or orange-colored spots. The color of the corolla

varies in different exposures and on different plants, with every shade of rose and flesh-color to pure white. The stamens are ten, very unequal, inclining towards the lower side of the flower, of the color of the corolla, on slender filaments, which are larger and densely covered with silky down near the base. The anthers consist of two short sacks, opening at the apex with round, bordered pores, and discharging white pollen. The ovary is roundish, surmounted by a curved style which gradually enlarges upwards and terminates in a broad, five-sided, stigmatic surface. The capsule is egg-shaped, five-angled and five-celled, with numerous, minute seeds.

The rose bay is found as far north as the town of Standish, on the borders of Sebago Lake, in Maine. It grows in great abundance in an extensive swamp in Medfield, not far from Charles River, and in a smaller one in Attleborough. It everywhere delights in deep, moist shades. In the Northern States, it occurs only at intervals, in protected situations. It is of more frequent occurrence in the Middle States, and in the deep valleys among the higher ranges of the Alleghanies, especially in Virginia, it becomes so abundant, according to Michaux, on the sides of the mountain torrents, as to form impenetrable thickets, in which the bear finds a secure retreat from the pursuit of dogs and hunters.

Pursh describes three marked varieties of the American Rose Bay. The first, with rose-colored flowers, found in the mountains, by rivulets and lakes, from Canada to Carolina, flowering in June and July; the second, with smaller flowers perfectly white, in the shady cedar swamps of New Jersey and Delaware, flowering in July and August; the third, with purple flowers, growing on the highest mountains of Virginia and Carolina, near lakes, and flowering in May and June. This last grows to a large size, with a stem eighteen inches in diameter, and foliage thrice the size of any other variety. He considers it as approaching the Pontic Rhododendron. The two former varieties, which differ only in the color and size of the flowers, are to be found in Massachusetts.

The Dwarf Rose Bay is readily cultivated, if planted in the peat or bog soil which is everywhere to be found in New Eng-

land, and if care be taken to protect it from the scorching heat of summer, and to place it in a sheltered situation where it shall not be exposed to the severest winds of winter. It richly deserves a place in every garden.

It is the most beautiful native flower of Massachusetts, and is singularly well fitted to ornament a parlor. A flower-bud not beginning to open has been placed in a vase, where it opened its flowers as well as if left on the stem; and the flowers continued fresh and beautiful more than fifteen days.

SECTION AZALEA.—The Azaleas differ from the true Rhododendrons in having only five stamens, and their leaves deciduous. They differ still more in habit and properties. The flowers are large and fragrant, and, in the different species, they are yellow, white, flesh-colored, rose-red, or variegated, and covered externally with hairs or with a glandular pubescence. The Pontic Azalea, the one longest known and cultivated, has yellow, orange or white flowers, which exhale a fragrance similar to that of the honeysuckle, but stronger, and reputed unwholesome.

Sp. 1. THE SWAMP PINK. WILD HONEYSUCKLE. *R. viscidum*.
Torrey. *Azalea viscosa*. L.

Figured in Audubon's Birds, II, Plate 115.

A flowering shrub, growing abundantly in open woods or on their borders, in low, wet grounds, in most parts of New England. Springing from a small root, with an ashen or slaty and various colored or clouded stem, seldom more than an inch in diameter, and throwing out branches in imperfect whorls or stages, this beautiful plant rises to a bushy head at six or eight feet from the ground. In the end of May, the season at which the flowering begins, it is remarkable for its large, cone-like flower-buds, composed of many scales, which, opening and falling, expose to view bunches of fragrant, irregular flowers. The leaves are alternate, or in tufts of five or six, at the end of the branchlets which encircle the flower-stalk. They are inversely egg-shaped, pointed at the end with a brown, callous

point, reflex and ciliate on the margin, smooth and sometimes shining above, with the mid-rib bristling beneath and tapering at base to a short stalk.

The flowers are six to twelve, in a diverging whorl or terminal corymb, their stems, when few, issuing from nearly the same point. At the foot of each green or colored flower-stem, are a white, hollow, obovate, bract-like scale, nearly as long as the stem, and one or two fugacious, thread-like bracts, much shorter. The stem and flower are covered with glandular, sometimes glutinous hairs. The calyx is usually short, with five rounded or pointed, ciliate or hairy teeth. The corolla is a white or scarlet, oblique tube, set with brownish, viscous hairs, and expanding into five unequal, reflexed, pink segments, of a pure white, or sometimes with a tint of flesh color within. Three or four stamens are usually longer, and one or two shorter than the corolla, with scarlet threads, downy below and smooth above, bending upwards and supporting a light, rust-colored, linear anther, opening obliquely at the extremity by two round pores. The ovary, at flowering, is a five-sided pyramid. The style is scarlet, slightly hairy, a little longer than the stamen, with a capitate stigma. The fruit, which often remains on the stem till the flowers of the succeeding season appear, is a dry, five-celled, many-seeded capsule, with valves opening from the centre and top, and having the persistent, sickle-shaped style at the end of the central axis.

There are many permanent varieties of this plant in its native state, differing in the color and viscidness of the flowers, the shape of the calyx-segments, and the color of the leaves. The most marked are

Var. 1.—*Glaucum* of Pursh, in which the leaves are green above and glaucous beneath.

Var. 2.—Leaves pale above and glaucous beneath, with the teeth of the calyx long, spatulate and reflexed.

Var. 3.—Leaves glaucous on both surfaces and with later flowers.

Few flower plants have been more valued and cultivated in European gardens than this. None more readily hybridizes with the other rhododendrons and azaleas. In Loddige's Cata-

logue for 1836, more than one hundred hybrid varieties are enumerated, most of them beautiful.

Sp. 2. THE UPRIGHT HONEYSUCKLE. *R. nudiflorum*. Torrey.
Azalea nudiflora. L.

Figured in Abbott's Insects of Georgia, I, Plate 27.

A low, spreading shrub, distinguished from the last by its broader and fuller leaves and more highly colored flowers. These are in bunches of six or more, radiating from one or two points. The flower-stems are longer than the tube, deeply colored and set with short hairs. Calyx of five, oblong, short sepals, unequal, with a row of hairs on the edge. Tube of the corolla dark red, border shorter and of a fainter color. The very prominent stamens are of a dark maroon color, as is the still longer style. Stigma rounded, dark purple.

This is found in the southern part of the State, towards the borders of Rhode Island, and in several parts of Worcester County, but far less abundantly than the last. It, however, grows as freely in the open air, and shows the same tendency to produce varieties and the same facility in hybridizing. Nine distinct varieties, native or occurring in cultivation, are described by Don, and forty-three additional ones are enumerated in Loddige's Catalogue.

The rhododendrons grow in almost any soil, if in a situation protected from the cold winds of winter and the burning sun of summer; and I have seen the *maximum* flourishing where exposed to both. But they do best in a somewhat close and tenacious soil, rather moist. They may be propagated by cuttings, by layers or by seeds. The latter mode is considered best; the seeds to be sown in peat soil or in fine, sandy loam, in a shady border. When transplanted, they should have a ball of earth left adhering to the roots.

THE RHODORA. *RIHODORA*. L.

From *rhodon*, a rose.

Calyx five-toothed; corolla two-lipped; stamens ten; capsule five-celled, five-valved; leaves deciduous.

THE CANADA RHODORA. *R. rhodora*. Don. *Rhodora Canadensis*. L.

An early flowering shrub, from one to three feet high, distinguished for its copper-colored stem and glaucous leaves, and clusters of naked flowers coming out before the leaves appear. The recent shoots are straight and erect, of a light brown, sometimes hairy, enlarging gradually to the extremity. The shoots of the preceding year are covered with a porcelain-like cuticle, which peels off, and leaves, on the older branches, and irregular, crooked stems, a bright, copper-colored, smooth bark. The leaves are borne on short footstalks, narrow, lance-shaped or oval, acute at each extremity, revolute at the margin, pale green or glaucous above, lighter and glaucous and downy beneath.

The flowers are in little tufts at the end of the branches. The stem is very short and somewhat hairy. The calyx is very minute. The purple or rose-colored corolla is deeply cleft, and seems to consist of two narrow petals, round at the end, and one broader, ending in three lobes. The three are slightly united at base. Stamens ten, as long as the corolla, with filaments somewhat hairy below, sustaining short, roundish, purple anthers, opening by two terminal pores. Ovary bristly. Style purple, longer than the stamens, supporting a large stigma. The capsules are half an inch long, divided into five cells by valves which open inwards, the partitions being formed by the margins of the valves turned inwards. At the time of flowering, the leaves are just beginning to be visible, covered with hairs, pushing from the very small, scaly leaf-buds. This plant, which flowers in April or May, is found in the neighborhood of Boston, and not unfrequently in wet land in other parts of the State. It also occurs in Newfoundland, in Maine, and in Connecticut.

XX. 10. THE AMERICAN LAUREL. *KALMIA*. L.

A small genus of beautiful, flowering, American plants, named by Linnæus in honor of Peter Kalm, a favorite pupil, a traveler and distinguished botanist. The leaves are alternate or in

ternate whorls, and evergreen, except in the species, *K. cuneata*, in which they are deciduous; the flowers in terminal clusters or compound corymbs; the buds are naked. The flowers are rose-colored, purplish or white. The calyx is five-parted; corolla salver-shaped, with a five-lobed border with ten horn-like projections on the lower surface, in the cavities of which above, the anthers nestle. Stamens ten, with anthers opening by oblique pores. Capsule five-celled, many-seeded, the partitions formed by the borders of the valves. Five species are known, two of them in Carolina and Florida, the other three in New England. Most of the species are considered poisonous; one of them, the narrow-leaved, is known to be fatal to lambs, and gets its common name thence. Mr. Nuttall thinks it not improbable that the deleterious honey sometimes complained of, may have received its injurious property from the flowers of the *Kalmia latifolia*. Kalm, who paid much attention to the genus, says that the leaves of this species are found to be poisonous to calves and lambs, and deleterious to cattle, sheep and horses; while they are the food of stags when the snow covers the ground and hides other provision from them. The occasionally poisonous quality of the flesh of partridges has been attributed to their feeding on the buds of *Kalmia*; but Wilson, the ornithologist, says he has eaten freely and without ill consequences, upon the flesh of these birds, when their crops had been found distended with *Kalmia* buds. Dr. Barton considers the *Kalmia* deleterious to the human system, and says that the Indians made use of a decoction of the leaves to destroy themselves. Dr. Bigelow, who has collected the facts in relation to this subject, and himself made experiments and chemical analyses to ascertain the properties of *Kalmia latifolia*, is inclined to think that "the noxious effect of the *Kalmia* upon young grazing animals, may be in some measure attributed to its indigestible quality, owing to the quantity of resin contained in the leaves."

Sp. 1. THE MOUNTAIN LAUREL. CLAMOUN. SPOONWOOD.
K. latifolia. L.

Figured in Bigelow's Medical Botany, I, Plate 13; also in Catesby's Carolina, II, Plate 98; Abbott's Insects, I, Plate 37; and in Audubon's Birds, I, Plate 55.

This extremely beautiful shrub occurs in various parts of the State; on the shores of Massachusetts Bay, at Cohasset, in several points on both sides of Buzzard's Bay, in the neighborhood of Newburyport and Lowell, in many parts of Worcester County, on every side of Wachusett, and in the towns on both declivities of the Green Mountains. In the deep, shady ravines of these mountains, it sometimes attains a height of fifteen or even twenty feet, with a diameter of three or four inches. In most other places, and especially on open ground, it rarely exceeds four or five feet in height. On an open, rocky pasture of many acres, south of Meeting-house Pond in Westboro', it forms large, close, clumps or islets, intersected by plots and alleys of grass. In June and July, when every one of these innumerable green islets is crowned with white or rose-colored flowers, and cattle are feeding on the grass or lying under the few oaks which are scattered through the pasture,—the whole, with the lake and its fringe of trees, is worth going out of one's way to see.

The Indians called this plant *clamoun*. It is sometimes called spoonwood, rarely calico bush; most frequently, mountain laurel, or broad-leaved *Kalmia*.

The stem of the mountain laurel is slender, with branches in twos or threes, or in imperfect whorls. The bark on the recent branchlets is of a yellowish green, which in a year begins to turn brown, and afterwards becomes ash-colored. The epidermis on the older stems easily and often peels off in long plates, leaving a brownish or grayish bark. The principal stem in old stocks is covered with a grayish brown, entire bark, cleft regularly with long, smooth clefts. This difference in bark often gives the branches the appearance of having been grafted. The leaves are scattered, opposite, or in whorls or tufts, from two to four inches long, and two fifths as broad, oval, acute at each

extremity, very entire, polished above, somewhat reflexed at the edge, with the mid-rib prominent, of a soft, leathery texture, on footstalks one quarter or one third of their length. The flowers are in terminal heads which crown the last year's leaves, and consist of two or three stout stems proceeding from the axil of as many leaves, and giving off from one to three pairs of opposite branches. The partial flower-stalks are an inch or more long, covered with glandular hairs. Each branch and partial stalk has a short, pointed bract at its base, and a shorter ovate one on each side. The calyx is persistent, of five, short, ovate, pointed segments, covered with glutinous hairs, and green, with colored tips, expanded till the corolla has fallen, after which it embraces the ovary. The corolla is monopetalous; before opening it has the shape of a ten-angled casket; on expansion it becomes salver-shaped, with a short tube and a border of five, triangular, raised lobes. The stamens are ten, with white filaments, bent back and nestling their brown anthers in little cavities in the side of the corolla. On being touched, they escape with a spring and bend over, around the pistil. The anthers open with two oblique, terminal pores. The color of the corolla varies from a pure white to a rich rose. The border of the tube within is painted with a waving, rosy line, and there is a delicate pencilling of purple above each depression for the anthers. The ovary is round, green, with white, glandular hairs, and an erect, club-shaped pistil, longer than the stamens, and remaining after the corolla has fallen. The capsule is globular, imperfectly five-angled, set with glandular, glutinous hairs, five-celled and five-valved, with numerous minute, compressed seeds, attached to the central axis.

The wood of the mountain laurel is very smooth, close-grained and hard, and that of the root is marked with red lines. It is substituted for box, is well adapted to the turner's use, and for the engraver on wood, and is employed in making the handles of small tools, screws, boxes, and musical instruments.

Found in nearly all parts of the State, and from Canada to Florida. Flowering in June and July. Easily cultivated in a moist soil, and richly deserving a place in every American garden.

Sp. 2. THE NARROW-LEAVED KALMIA. *K. angustifolia*. L.

Figured in Catesby's Carolina, I, Plate 117, where it is called *Chamædaphne sempervirens*. Audubon's Birds, II, Plate 195.

A low, evergreen shrub, usually half a foot or a foot high, rarely two feet, forming often small tufts or patches in low grounds. The stem is ascending, covered with a brown bark, shining through the thin, membranaceous silvery epidermis, in recent shoots of a light reddish green. Branches often in threes. Leaves in whorls of three, entire, lance-shaped, revolute on the margin, with the mid-rib very prominent beneath, shining green above, paler and often rusty beneath, of a soft, leathery texture, those of the previous year browner and harder. Flowers in corymbs, in from three to twelve whorls of three, in the axils of the persistent last year's leaves, and surmounted by the new leaves. In each axil is a panicle consisting of about three imperfect whorls of three flowers. At the base of each flower-stem is a small linear bract, and two smaller ones on the sides. The flowers are very beautiful, of a deep rose-red.

From its supposed poisonous effect upon lambs, this plant is often called *lamb-kill* or *sheep-kill*. It is found from Hudson's Bay to Georgia.

There are many slight varieties of this plant, some of them remarkable for leaves glaucous beneath and somewhat so above.

Sp. 3. THE GLAUCOUS KALMIA. *K. glauca*. Aiton.

Figured in Audubon's Birds, II, Plate 193.

An almost aquatic plant, with a long, straggling stem, with a greenish brown, smooth bark, and slender, two-edged, opposite branches, or three-edged in whorls of three. The leaves are opposite, or in threes, nearly sessile, linear-lance-shaped, entire, obtuse or pointed, wedge-shaped at base, revolute at the edge, of a brilliant dark green above, whitish or glaucous beneath. Flowers in terminal corymbs, made of alternately opposite pairs, or in threes, from the axil of a small leaf or bract, with two lateral scales. Footstalks thread-like, three fourths of an inch long. Calyx persistent, with five long, obtuse, brown segments.

Corolla pale rose-colored, with cavities to receive the ten anthers, which are supported on stamens proceeding from the central portion of the corolla, with filaments surrounded by a circle of hairs at the base, and brown anthers.

This plant is found in Richmond, in Berkshire, and in a few other places in the State. Dr. Alexander pointed it out to me in Hubbardston, growing with *Ledum*, in an open, sphagnous swamp, which had been used as a reservoir for a mill-stream, and had thus been kept full of water nearly throughout the year. When I gathered these plants there, the swamp was overgrown with a most abundant growth of *Cassandra calyculata*, covering the surface with a purplish brown hue. Amidst this the sphagnum had formed masses a foot or two above the general level, on which the *Ledum* and *Kalmia* were growing; their long, prostrate, root-like stems penetrating to a considerable distance in the spongy mass. On the edges were *Rhodora* and *Andromeda*; the general, more wet level was occupied by cotton grass, and the dry banks by narrow-leaved *Kalmia*, huckleberries and other shrubs that avoid the water. It is found from near the Arctic circle in Canada to Pennsylvania.

The flower of *Kalmia glauca* has been compared to a miniature parasol, the corolla to the covering, the stamens to the ribs, and the style to the handle.

XX. 11. THE LABRADOR TEA. *LEDUM*. L.

A genus of two species of low, evergreen undershrubs, with alternate, coriaceous leaves, more or less revolute, downy beneath, odorous when crushed; and white flowers in terminal corymbs,—found in cool, wet places, in the northern regions of both continents. The calyx is five-toothed; the corolla has five spreading petals; stamens five or ten; capsule five-celled, many-seeded, with five valves opening from the bottom upwards; seeds numerous, linear, with a membranous wing on each side. The species which is common to the two continents, has a bitter and astringent taste and narcotic properties. In Russia, the leaves are used in tanning, and are substituted for hops in beer, which has, in consequence, the property of causing headache and vertigo. One species is found in Massachusetts.

THE BROAD-LEAVED LEDUM. LABRADOR TEA. *L. latifolium*. L.

Figured in Audubon's Birds of America, II, Plate 191.

A low, evergreen, branching shrub, with the recent shoots and under surface of the leaves densely covered with rust-colored wool. The older branches are reddish brown or copper-colored; the stem is nearly black. The leaves are on very short footstalks, lance-shaped, obtuse, with the border much revolute, of a light green above, and covered with a rusty down or wool beneath. Flowers erect, in crowded, terminal corymbs, on slender, somewhat downy stems, rising from the bosom of a short, concave bract, covered with resinous dots. The calyx is minute, with five obtuse teeth. Corolla of five, oblong, rounded, white petals. Stamens from five to ten, as long as the petals, on slender filaments, with small, white, or yellowish anthers opening by two terminal pores. Ovary roundish. Style white, turning red, as long as the stamens, persistent, with a small stigma. The capsule is oblong-oval, crowned with the style, and supported by the calyx, nodding until it begins to open, which it does by five valves at bottom, when it is inverted and pendent. The leaves growing on branches near the ground, are sometimes nearly destitute of wool, and are flat, short, elliptical, and scattered with resinous dots beneath. The root or subterranean stem is large, and throws out numerous, wool-like radicles. Flowers in May and June.

In Labrador, its leaves have been used as a substitute for tea. It is found in all the countries north of us, and in sphagnum swamps in Pittsfield, Richmond, and Hubbardston, in this State. The ledum may be cultivated in a peat soil or sandy loam, and is readily propagated by layers or by seeds.

FAMILY XXI. THE WHORTLEBERRY FAMILY. *VACCINIEÆ*.

DE CANDOLLE.

The whortleberries and cranberries take the place, throughout the northern part of this continent, of the heaths of the corresponding climates of Europe; and fill it with not less of beauty, and incomparably more of use. This family includes erect or creeping shrubs, with numerous, irregular branches, simple, alternate leaves, on short stalks, sometimes coriaceous and perennial, and flowers solitary or in racemes. The characteristics are nearly those of the previous family; calyx adherent to the ovary, entire, or with from four to six lobes, with which the equally numerous lobes of the corolla alternate; the stamens double that number and distinct, with two-horned anthers opening by pores, or short slits; ovary four- or five-celled; style and stigma simple; berry crowned by the persistent limb of the calyx, succulent, four- or five-, or eight- or ten-celled; cells one- or many-seeded; seeds minute.

This family has usually been made a tribe of the Heath Family, from which it differs essentially only in its juicy fruit surmounted by the calyx-segments. Most of the plants which it comprehends bear pleasant and wholesome fruits, and are found chiefly in the temperate, or on mountains in the warmer regions of America. Some are found in Europe; some on the continent and islands of Asia, and on islands in the Atlantic, Pacific and Indian Oceans. The leaves and bark have astringent and tonic properties. Many species deserve cultivation for their beauty.

Three genera are found in Massachusetts:—

The Whortleberry, with erect stems, ovoid corollas, and agreeably acidulous fruit;

The Cranberry, with creeping stems, expanded or revolute corolla, and acid fruit; and

The *Chiógenes*, with creeping stems, bell-shaped corolla, and white, pleasant fruit with a chequer-berry flavor.

XXI. 1. THE WHORTLEBERRY. *VACCFNIUM*. L.

A genus of nearly eighty species of shrubs and undershrubs, rarely small trees, occurring most numerous in North America, and less frequently in tropical America, Madagascar, northern India, the Sandwich Islands, middle and northern Europe and northern Asia, with alternate, sometimes evergreen leaves, and solitary or racemed flowers and fruit. Most of the species bear edible and wholesome berries. The bark and leaves of the three European species are very astringent, and have been much employed in tanning. The fruit of the Bilberry, *V. myrtillus*, the best of the three, is highly esteemed for its agreeably acidulous taste. Vinous and alcoholic drinks and vinegar are prepared from it. The juice, with lime, verdigris, and sal ammoniac, furnishes the painter a beautiful purple color; with sulphate of copper and alum, it gives a blue, of no great permanence, but often used in the preparation of colored paper. The name *whortleberry*, originally given to this species, is derived from the Saxon *heort-berg* or *heorot-berg*, the hart's berry. Similar uses are made of the Bog Whortleberry, *V. uliginosum*, of Europe, which is inferior in flavor. Of the leaves of this, with *Lycopodium alpinum*, the Icelanders make a yellow dye for woollens.

Most of the whortleberries in New England change their leaves in autumn to different deep shades of scarlet and crimson, contributing, more than any other family, to the peculiar richness of coloring which characterizes our woods at that season.

Sp. 1. THE BLACK WHORTLEBERRY. *V. resinosum*. Aiton.

A shrub from eighteen inches to three feet high, rather erect; much branched; the branches slender, and, when young, pubescent. Stem mahogany color, beneath a semi-transparent, pearly epidermis. Leaves on lateral or terminal branches, with short petioles, oblong-oval or elliptic, very entire, mostly obtuse, thin, profusely dotted beneath with atoms of yellowish resinous matter, giving a yellowish green color to the lower surface. Flowers on short, lateral racemes, with minute, lance-

olate, colored bracts near the base of the stalks. Calyx yellowish green from the resinous dots; segments acute; corolla small, five-angled, ovate, conic, contracted at the mouth, of a dark, dull red, with sometimes a tinge of pale yellow below. Stamens shorter than the corolla. Style projecting beyond the corolla. Stigma capitate. The berries are globular, of a shining black color, and sweet. A horizontal section shows them to have ten cells, in each of which is one hard, stony seed; only two or three of the whole number coming to perfection. This fruit is more firm than that of any other species, and is more valued in market.

The common variety has black, shining berries, and leaves green on both surfaces.

A second variety has similar leaves and berries covered with a blackish or brownish bloom, and very sweet.

A third variety has somewhat glaucous leaves, and berries covered with a glaucous bloom.

A fourth variety has larger berries, of a bluish color, with a bluish bloom, and very rich to the taste.

There are other varieties, differing in color as in fruit. Those I have mentioned are the most strongly marked.

In consequence, apparently, of the sting of some insect, the flower of this whortleberry sometimes expands to twenty or thirty times its natural size, and becomes of a fleshy texture, resembling the fungus-like excrescence common on the Swamp Pink, *Rhododéndron viscosum*. All the leaves on the end of a branch are sometimes affected in the same manner.

This whortleberry is found on rocky hills, and flowers in May. It occurs from Canada, and the shores of Lake Huron, to the mountains of Georgia.

Sp. 2. THE DANGLEBERRY. *V. frondosum*. L.

This is easily distinguished by its loose mode of flowering, and its large, pale leaves, which are glaucous beneath. It is a spreading bush, three or four feet high, with a crooked, much branched, light ash-colored stem. The recent shoots and fruit-stalks are of a light, pale green, or of a pale reddish yellow; the branches and stem of a mahogany or bronze color, unequally

covered with a pearly epidermis, which gives it an ashy color. The leaves are on very short petioles, oblong, elliptic, or obovate, obtuse, with a callous, whitish point, revolute on the margin, lighter beneath. The flowers hang dangling on slender strings from one to three inches long, with an ovate bract at base, and two minute bracts on opposite sides, about the middle. The calyx-segments are appressed and acute; the corolla a broad bell, like that of the lily of the valley, with five, short, angular segments, completely reflexed. The style is as long as the corolla; the stamens considerably shorter.

The fruit is large, bluish, rather acid, ripening late. It is rarely found in abundance; where it is procured in sufficient quantities, as in some parts of Worcester County, it is used for puddings. This species comes to greater perfection in a warmer climate. In Pennsylvania, its berries are preferred to those of any other whortleberry.

It is found in moist situations, by the side of lakes and on the edges of woods.

Sp. 3. THE BUSH WHORTLEBERRY. *V. dumosum*. Andrews.

A shrub one or two feet high, distinguished for its shining leaves, which are sessile, broad-lanceolate or obovate, wedge-shaped, acute, entire, mucronate or ending in a short, abrupt, awl-like point, conspicuously dotted *above* with resinous dots, and set, as are the recent shoots, with short, numerous, glutinous hairs, which, on the margin, give it a ciliate appearance. The stem and older branches are covered with an ash-colored, roughish bark; the recent branches are brownish, downy and somewhat viscid with a few glandular hairs. Racemes of five flowers, leafy, covered with the same glutinous hairs. Each pedicel proceeds from the axil of an oval leaflet, and is furnished, about its middle, with one to three bractiolæ. The segments of the glandular calyx are rather large, somewhat acute, and fringed. Corolla large, wax-white, often with a tinge of pink, rounded or funnel-shaped, remarkable for its five prominent, keel-like angles, with the segments obtuse and recurved. Anthers very long, brown, cleft nearly to their base into two needle-like threads, resting on the top of a short, fleshy, white

filament. Style as long as corolla. Berries large, black, crowned with the persistent calyx.

Found at Manchester, rare. Flowering in July.

Sp. 4. THE DEER BERRY. *V. stamineum*. L.

A bush about two feet high, with numerous, slender, tapering, somewhat downy, green branches, which afterwards turn brown. The leaves are oval or elliptic, often somewhat heart-shaped at base, acute at the end, slightly revolute on the margin, conspicuously veined, glaucous and somewhat downy beneath, on very short, downy footstalks. The largest are two inches long and one broad. The flowers are conspicuous for their very long, straight anthers, projecting far beyond the short, spreading, white corolla, with pointed lobes: at the base of each flower-stem is an ovate leaf, much smaller than the other leaves. Berries greenish, afterwards white, pear-shaped. Found at Southampton lead mine (Oakes), and elsewhere, in the western part of the State. Flowers in May and June, and ripens its scarcely eatable fruit in September.

Sp. 5. THE HIGH BUSH WHORTLEBERRY. SWAMP WHORTLEBERRY. *V. corymbosum*. L.

A shrub from four to eight or nine feet high, forming large, handsome clumps in swamps and moist woods, and maturing its fruit later than the upland species. It is crowded with irregular, straggling branches, which are downy and somewhat angular when young. The bark on the branches and stem is of a bronze or copper color, bleached, where exposed to much light, to a gray. It gradually becomes rough, and cleaves off. On the smaller, it is yellowish green, clouded with dark purple, and closely scattered with whitish dots. The leaves, at the time of flowering, are narrow, lanceolate, egg-shaped or inversely egg-shaped, or elliptic, and often very downy beneath, and pale green or purplish. They afterwards become much broader, without increasing in length; smooth on both surfaces, but somewhat downy along the mid-rib and often on the primary veins, of a soft green, paler beneath. The short, flower-bearing branches, the

growth of the previous year, are nearly leafless. The flowers are crowded towards the extremity, pendent or nodding, in short racemes, on stems one quarter or one third of an inch long. At the base of each stem are from one to three yellowish, membranous bracts, the middle one broad, hollow, rounded. The segments of the calyx project a little, are rather acute, and glaucous, with a reddish edge. The corolla is very large and showy, white, often tinged with purple, nearly cylindrical, contracted at the mouth, with tooth-like, spreading segments. The filaments are hairy, as long as the anthers. The anthers are attached above the base, the terminal distinct tubes opening towards the top obliquely. The berries are large, black, with a bluish bloom, sweet, with a very agreeable acidulous taste. The flowers appear in May and June, and the fruit ripens in August and September.

There are many varieties, differing in the size of the bush, which changes according to the soil, and in the size and color and shape of the corolla.

The BLACK SWAMP WHORTLEBERRY, (*V. disomorphum* of Michaux and Bigelow,) has leaves smaller and later; corolla much smaller and crowded, and berries very black and shining, crowned with an erect calyx; a variety with narrower and more acute leaves, with glandular serratures.

Sp. 6. THE BLUE WHORTLEBERRY. *V. virgatum*. Muhlenberg.

A shrub from one to three feet high, distinguished for the soft, light green of its leaves. Branches approaching to straight, or less crooked than in the previous species. Bark of the twigs yellowish green, sometimes clouded with dark purplish, very closely set with whitish dots, sometimes warts. Leaves on the lower, lateral branches, sessile, broad elliptic, or obovate wedge-form, with a brown acumination; waving, reflexed, often obtusely denticulate, smooth, of a light green, often purplish, with a glaucous tinge, lighter beneath. Flowers on terminal and lateral branchlets, above the leaf-branches, on racemes, with few or no bracts, or fugacious or very minute bracts. Teeth of the calyx rather acute, standing out, often red. Corolla ovate or

cylindric, yellowish white, often tinged with red, with spreading segments. Filaments shorter and less hairy than in the last.

This is a common species, growing on high ground and most luxuriantly in the openings in rocky woods. The fruit is very sweet, the berries large and covered with a light bluish bloom. The flowers are much more richly colored than those of other species, and the plant has a more elegant appearance. It is distinguished from any variety of the last species, by the veins and ribs of its leaves being usually perfectly smooth. It is distinguished at once from the next species, by its pale green leaves and by being twice as high or more. The fruit-branches are two or three inches long or more, without leaves, sometimes several together on a stem, so that a large part of the plant seems leafless, but covered with fruit. The flowers open in May and June; the fruit is ripe in August.

Sp. 7. THE LOW BLUEBERRY. *V. Pennsylvanicum*. Lamarck.

A very low and much branched undershrub, covering the ground in extensive beds, on open, level pastures or in high pine woods. The branches are a little angular, with the bark of a light green, closely set with white, raised dots, and with a hairy line running down on each side. The leaves are sessile, oval-lanceolate, acute at both ends, thin, finely serrate, shining on both surfaces, with the margin and mid-rib hairy under a microscope. The fascicles of flowers are terminal, or on the upper part of the branches, while the leaves are below. The bracts are often scarlet. The teeth of the calyx are green, acute, and spreading; the corolla is white, often with a reddish tinge; style equaling or surpassing the corolla; filaments short, rather hairy. The berries are blue, with a glaucous bloom, and very sweet.

From its situation and exposure, the berries ripen earlier than those of any other species. They are soft, and easily bruised and injured in bringing to market, and liable, when in mass, to speedy decay. They are, therefore, less valued in market than those of some other species, though they are very delicious and not liable to the objection which is made to the black whortle-

berry on account of its numerous, stony seeds. They are particularly suited to be preserved by drying, and, when prepared in that way, are equal in value to the imported currants, as an ingredient in cakes and puddings.

There is a variety of this whortleberry growing in the same situations and forming like it large beds, distinguished by its leaves of a darker green and shining black berries.

This lowest and earliest of the blueberries delights in a thin, sandy soil, and carpets the ground in the openings in the pitch pine woods, with beds of rich, soft green, which in May and June are decked with a profusion of beautiful flowers; in July and August are loaded with delicious fruit, and in October turn to a deep scarlet and crimson. Its rich, tender fruit feeds immense flocks of wild pigeons and numberless other animals. It is a peculiar blessing to the arid and otherwise barren, sandy plains, and helps the poor inhabitants, especially in seasons of scarcity, to eke out their bread-corn, to which it makes a wholesome and most agreeable addition.

Sp. 8. THE COWBERRY. *V. vitis idæa*. L.

This plant, so far as I know, occurs in only one spot in Massachusetts, which is in a pasture in Danvers, where it was found by Mr. Oakes in 1820, or before. It has some resemblance to the cranberry, but the leaves are larger and the branches larger and shorter. It has a creeping, woody root, with ascending angular branches a foot or more long. The leaves are coriaceous and shining, like those of box, but darker. The flowers are pale pink, four-cleft and with eight stamens. The berries are blood-red, acid and austere. In the north of Europe, where it abounds, it is used as the cranberry, but is inferior; formed into a jelly, it is thought superior to currant jelly, as a sauce for venison or roast beef, or as a remedy for colds and sore throats.

XXI. 2. THE CRANBERRY. *OXYCOCCUS*.

Persoon.

A genus of three North American species, one of which is also European, of creeping or rarely erect plants, with small, alternate, evergreen leaves, and red berries of a pleasant, but extremely acid taste. The calyx is four-toothed; the corolla has four long, narrow, revolute segments; the stamens are eight, with tubular, two-parted anthers; the berry is four-celled and many-seeded. The erect species grows on the highest mountains of Carolina, and bears transparent, scarlet berries, of an exquisite flavor; the other two species are found here.

Sp. 1. THE COMMON CRANBERRY. *O. macrocarpus*. Pursh.

Figured in Barton's North American Flora, I, Plate 17.

Stem prostrate, creeping, near the surface of the earth, to the distance of two or three feet, and throwing out numerous, thread-like roots. Flowering branches erect, with flowers and fruit from the lower part of the shoot, or sarmentose, and erect at the extremity, the bark on the older shoots shivering off in threads, smooth, or sometimes downy, recent ones light brown.

Leaves on very short footstalks, oval, oblong, entire, or with distant, indistinct teeth, sometimes minutely downy at the end when young, revolute at the margin, green above, whitish beneath, seldom half an inch long. Flower-stalk thread-like, in the axil of a shortened leaf, an inch long, reflected at the end, downy, with two small, ovate, pointed bracts at the flexure, beyond which the footstalk is more attenuated, downy and green.

Flowers nodding, calyx short, persistent; corolla pale-red, very long, revolute; anthers projecting, very long, somewhat downy below, divided above into two tubes, which open by a somewhat oblique pore.

Fruit of a bright scarlet color, globular or pear-shaped, with the four blunt teeth of the calyx adhering to it; four-celled, with numerous seeds attached to the central division. It often remains on the vine through the winter, so that it is not uncommon to find flowers and mature fruit on the same plant.

The cranberry is found in every part of the State, in large beds in boggy meadows. The berries are gathered in great quantities, and used for making tarts and sauce, for which purpose they are superior to any other article, especially as they have the advantage of being kept without difficulty throughout the winter. Their quality is much improved by being allowed to become perfectly ripe on the vines. Great quantities of the berries are exported to Europe.

Found from the Arctic sea-shore to New Jersey, and from Newfoundland to the Rocky Mountains.

Sp. 2. THE EUROPEAN CRANBERRY. *O. palustris*. Persoon.

This plant, which has been found by Mr. Oakes on Nantucket, in Pittsfield, and near Sherburne, has so near a resemblance to the common cranberry, that it would be taken by most persons for a small variety of it. It is distinguished by its very small, *pointed* leaves, rarely a fourth part of an inch in length, and the short *ovate* segments of the corolla. It is the common cranberry of the north of Europe, where it grows in turfy, mossy bogs, particularly on mountains. Its berries are applied to the same purposes as our cranberry, and great quantities are sent from Russia to the more southern countries.

XXI. 3. THE MOUNTAIN PARTRIDGE BERRY.

CHIOGENES. Salisbury.

A North American genus of a single species. "The limb of the calyx is four-cleft; the corolla broadly campanulate, deeply four-cleft; stamens eight, included, inserted into the margin of the even disk; filaments very short and thickened, ovate, glabrous; anthers of two ovate-oblong cells, fixed by the base, not awned on the back; each 2-cuspidate at the apex, and opening longitudinally along the inside from the summit to below the middle. Ovary four-celled, free only at the convex summit; style slender. Fruit white, crowned with the limb of the calyx, four-celled, many seeded."—A. Gray: * *from the manuscript of the N. A. Flora*.

* I owe it to the kindness of Prof. Gray that I have been allowed to copy from his manuscript, the above generic description, which fixes, for the first time, the

C. hispidula. Gray.

An evergreen plant, with a woody stem, creeping on the earth or beneath the decayed leaves, within deep, shady woods, and sending out numerous, prostrate, filiform branches, rough with appressed, ferruginous bristles. The flowers are solitary, on short, recurved stems, in the axil of a leaf, with two ovate, concave, hispid bracts. Calyx of four pointed segments, surmounting the ovary and forming a part of the succulent berry. Corolla small, white, bell-shaped, somewhat four-sided. Berry white, eatable, juicy, and of an agreeable subacid taste, with a pleasant chequer-berry flavor. The whole plant has the aromatic taste and smell of *Gaulthèria procumbens*. The leaves are about one third of an inch long, nearly orbicular, acute at the end, rounded or acute at base, reflexed at the margin, smooth above, paler and scattered with stiff hairs beneath.

Flowers in May and June. Mr. Tuckerman tells me that this plant is abundant on the sides of the White Mountains, where it forms, with its creeping stems, large, thin mats, beneath which, when lifted up, the pleasant berries are found in luxuriant profusion. This plant evidently takes its place between *Oxycoccus* and *Gaulthèria*, the former of which it resembles in habit, the latter in properties.

THE TRUMPET FLOWER FAMILY, *Bignoniaceæ*, a rather large family of trees, climbing shrubs and herbaceous plants, with large, trumpet-shaped, showy flowers, contains three genera,—two Trumpet Flowers *Bignonia* and *Tecoma* and the Catalpa, which are somewhat extensively introduced as ornamental plants, but are not found growing naturally in this State, nor probably in any part of New England.

position of a plant, which, ever since its first detection, has been wandering from genus to genus, suing in vain for admittance at the gates of four old genera and two new ones, and at last obtaining, from his faithful examination of its case, a character, a habitation and a home, in a seventh.

CHAPTER V.

PLANTS WITH THE PETALS AND STAMENS GROWING FROM THE CALYX,
EXCEPT IN CORNUS.

FAMILY XXII. THE CORNUS FAMILY. *CORNA'CEÆ*.
DE CANDOLLE.

THIS family contains trees or shrubs and perennial herbs, with opposite, rarely alternate, entire leaves, pinnately veined and without stipules, and with flowers in umbels or cymes. The calyx coheres with the two- or rarely three-celled ovary, and has a small, four-toothed border. The corolla is of four deciduous petals, growing from the top of the calyx-tube and alternate with its teeth. The stamens are four, alternate with the petals. Fruit a two-, rarely three-celled drupe, with solitary seeds, and crowned with the remains of the calyx. The plants of this family are found in the temperate and cooler regions of both continents, particularly in North America and Nepaul. None of the family are hurtful. They are generally bitter and astringent; and the bark and leaves of several, particularly of *Cornus flórida* and *C. sericea*, have been used with efficacy in fevers. The berries of some species, as, for example, of *C. Canadénsis*, are edible, but not very pleasant. The wood of the cornels is hard and close-grained, and is used in Europe for cogs, in mill-wheels, and for other small articles formed by the turner; and in this country as a substitute for box-wood.

XXII. THE CORNEL. *CORNUS*. Tournefort.

Shrubs or small trees, with entire, deciduous leaves, minutely rough with appressed, bicuspidate hairs, and white or rarely yellow flowers. The trunk is sometimes subterraneous, throwing up annual, herbaceous branches. There are about twenty species, of which eleven are, according to Torrey and Gray, found in America, north of Mexico, two are found in Mexico, three in Nepaul, one in Japan, two are common to Europe and

Asia, and one is found in all the northern parts of both continents. The bark is very bitter and tonic. Hardy plants, some of them highly ornamental, easily propagated by seed, by suckers, or by layers or cuttings.

SECTION FIRST.—*Flowers in cymes, without an involucre.*

Sp. 1. THE ALTERNATE-LEAVED CORNEL. *C. alternifolia*. L.

A beautiful shrub, six to eight feet high, sometimes a graceful small tree of fifteen, twenty, or even twenty-five feet, throwing off, at one or more points, several branches which, slightly ascending, diverge and form nearly horizontal, umbrageous stages or flats of leaves, so closely arranged as to give almost a perfect shade. It is distinguished from the other species by having its leaves and branches alternate. Recent shoots of a shining light yellowish green, with oblong, scattered, lenticellar dots. The older branches of a rich, polished green, striate with gray, the striæ at last occupying almost the whole surface, and only at intervals allowing the then purple bark to shine through. Leaves alternate, on long, round, channelled footstalks, oval or elliptic, acute or wedge-shaped at base, with a long acumination, entire, somewhat revolute at the margin, dark green, shining, deeply channelled above, glaucous or hoary, with silken, bicuspidate hairs beneath.

Flowers in an irregularly branched head or cyme; the partial footstalks not rising from one point, as in others of this genus, but alternate and very unequal; calyx with four very minute teeth, and, like the pedicels, hairy. Corolla of four oblong, pointed, white, or pale yellow, reflexed segments; stamens four, longer than the corolla, large, tapering, with yellowish white anthers; style short, with a capitate stigma. Fruit blue-black.

A beautiful plant, with a great variety of character. It grows naturally in moist woods or on the sides of hills; but when cultivated, flourishes in almost every kind of soil, and even in very dry situations. It flowers in May and June, and the fruit ripens in October.

It is sometimes five inches in diameter. It is found from Canada to Carolina, and westward to Kentucky.

Sp. 2. THE ROUND-LEAVED CORNEL. *C. circinata*. L'Héritier.

A spreading shrub, usually not erect, from four to six, sometimes eight or ten feet high, with straight, slender, spreading branches. Recent shoots green, profusely blotched with purple, and verrucose near the leaves; older shoots pale yellowish green or purplish, thickly dotted with prominent, wart-like dots, or sometimes smooth. Branches opposite, spreading at a large angle, yellowish green, blotched and clouded with purple.

Leaves opposite, nearly round, with an abrupt acumination, rather rough, with very deeply impressed veins above, glaucous beneath with whitish down, veins very prominent. The lower and terminal leaves on the fertile stems, are very large, four or five inches long and nearly of the same breadth; the upper leaves smaller and less orbicular. Flowers in terminal, open, spreading, rounded cymes, on rather short, downy stalks. Petals lanceolate or egg-shaped, pointed, white; style short, stout, green, persistent, with a capitate stigma. Fruit blue, turning to a whitish color. It flowers in May, and its fruit ripens in October.

Found from Canada to the mountains of Virginia.

Sp. 3. THE RED-STEMMED CORNEL. *C. stolonifera*. Michaux.

A handsome plant, conspicuous at all seasons of the year, but especially towards the end of winter, for its rich red, almost blood-colored stems and shoots. The main stem is usually prostrate upon the ground, beneath withered leaves, throwing down roots and sending up slender, erect branches. These sometimes rise to the height of eight or ten feet, but usually five or six. The bark is smooth, of a dark purplish or sanguine red, sparsely scattered with large, brown, wart-like dots. The leaves are large, ovate, rounded at base, suddenly tapering to a short point, roughish on both surfaces, whitish beneath.

The fruit is white or lead-colored. Nuttall says, "The fruit of this species, though bitter and unpalatable, is eaten by the

savages of the Missouri, from whence it (the plant) seems to extend across the continent and appears again in Siberia." Torrey and Gray show that the Siberian plant is another species, *C. alba*.

It occurs plentifully in swamps in Berkshire; and is found from Newfoundland, through Canada and the Northern States to latitude 42°, and west to Ohio.—*Fl. N. A.*, I, 650.

Sp. 4. THE PANICLED CORNEL. *C. paniculata*. L'Heritier.

A slender plant, from four to eight feet high, growing by the borders of fields and woods, in dry situations, and along the banks of streams and on hill-sides, and making a beautiful appearance when in flower. It has an upright stem, and slender, erect, opposite branches, covered with a grayish bark. The recent shoots are of a pale yellowish green with a brown tinge, sparsely dotted with brown. The leaves are ovate-lanceolate, tapering at base, and ending in a fine long point, on short footstalks doubly channelled above. On both surfaces, are visible, with a magnifier, numerous close-pressed, minute hairs. The under surface is whitish. The cymes, or heads of flowers are very numerous, on long, slender, pale yellow stems, with irregular branches. The calyx-tube is covered with a white, silky down, and ends in minute, recurved, hairy teeth. The margin of the ovary, which fills the cup, is purple or red. The petals pointed, lance-shaped, white. Stamens erect, white. Style club-shaped. The fruit is pale white, small, depressed, globose, like an apple, the short style standing in the terminal cavity.

Flowers in May and June. Fruit matures in August and September, when the fruit-stalk is of a delicate pale scarlet.

Sp. 5. THE SILKY CORNEL. *C. sericea*. L.

A showy, erect plant, somewhat spreading, growing along the banks of streams, and in wet meadows and on moist hills, by fences, five to ten feet high. The branches and upper part of the stem are purple, sprinkled, on the older stocks, with rusty gray, and often entirely gray or brown. Recent shoots green, or purplish green, and, with the leaf- and fruit-stalks, usually

invested with a silky down, especially above, but sometimes almost smooth.

The leaves are opposite, two or three inches long, sometimes more, but less than half as broad, ovate-lanceolate, oblong or elliptic, rounded or tapering at base, ending in a rather long point. They are dark green, entire, nearly smooth or with a few hairs above, paler, with ferruginous hairs, particularly on the mid-rib and veins beneath. The footstalk is half an inch long, round, plain and purple above, hairy. The shoots from the root are green and downy, and bear larger and rather smoother leaves. The upper leaves, particularly those next the flower-stalk, are very broad, those below and on the other branches, longer and narrower.

The cymes are terminal, numerous, on round footstalks, an inch or more in length, silky or downy, flat or hollow above, not large. Calyx oblong, downy, with long, lanceolate, acute, greenish segments; petals tapering, bluntly pointed, yellow without, white within. The stamens are as long as the petals or longer, bearing large anthers. The style, which proceeds from a purple ovary, is large and ends in a head.

But little of the fruit is matured. The berries, particularly the abortive ones, retain the four lanceolate segments of the calyx and the capitate style.

The bark of the silky cornel possesses, according to Dr. Barton, the same properties as that of the Flowering Dogwood, and has often been successfully used as a substitute for Peruvian bark.

This plant is very abundant in the neighborhood of Boston and in the middle of the State. It occurs from Canada to Georgia and Louisiana. It flowers in May and June, and ripens its fruit in September.

SECTION SECOND.—*Trees, with flowers in heads, surrounded by whorls of colored, petal-like leaves.*

Sp. 6. THE FLOWERING DOGWOOD. *C. florida*. L.

Fruit and leaves figured in Abbott's Insects of Georgia, II, Plate 73. Represented in Audubon's Birds, in flower, I, Plate 8; in fruit, I, Plate 73; the leaves, II, Plate 122. Michaux, Sylva, leaves, flowers and ripened fruit, I, Plate 48. Bigelow's Medical Botany, Plate 28.

The Flowering Dogwood is the most beautiful and showy of its genus. The flowers are very numerous, and when they are expanded in May, the tree is conspicuous at a great distance, shining through the woods, or showing like a flower among the green delicate foliage. It is a round-headed, small tree, usually twelve or fifteen feet high, but often rising to twenty-five or thirty, with a diameter of nine or ten inches. The recent shoots are of a grayish or purplish green, covered with a fine, soft, dusty down; those of the previous year are purple, marked with rings, afterwards becoming a light gray, which, in the larger branches, is closely striate with brown. The stem is rough, with short, broken ridges, produced by crooked furrows, between which the bark is sometimes divided in a somewhat regular manner into small, square, polygonal, or roundish plates.

The leaves are large, four or five inches long, and two or three wide, of a round-oval form, with an abrupt, prolonged termination, and abruptly tapering at base to a short, channelled footstalk. They are entire, smooth above, with depressions at the nerves, whitish beneath, hairy along the mid-rib and veins, and with scattered, bicuspidate hairs between.

In May, or the beginning of June, it is decked with a profusion of large, showy, white flowers, forming a conspicuous ornament of the early summer woods.

The flowers are at the ends of the branches, supported by a club-shaped footstalk. They are twelve or more in a head, surrounded by a whorl of four large, floral leaves, usually taken for the flower and constituting its principal beauty. Each floral leaf is petal-like, nerved, obovate, wedge-shaped at base, round-

ed at the end, and notched by the elevation of the hard, colored point, about which is often a shade of flesh-color or purple. The individual flowers are very small, sessile, crowded on a common receptacle, with a few minute, rounded scales at their base. A calyx of one green piece, investing the ovary and ending in four obtuse teeth, contains four slender, reflexed, oblong, fugacious, greenish-yellow petals, four erect stamens with oblong anthers, and a persistent, capitate style, somewhat shorter, rising from a brownish, circular disk.

The fruit is in bunches on the enlarged, club-shaped footstalk, of a bright scarlet, oblong-egg-shaped, crowned with the dark purple calyx. They are bitter and unpleasant, but, when touched by the frost, help to furnish food to the robin and other birds that remain with us during winter. At the time of maturity, they appear in the fork of two opposite branchlets, which end in the casket-shaped flower-bud of the succeeding year.

The leaves early begin to change to a purple, and turn to a rich scarlet or crimson above, with light russet beneath, or to crimson on a buff or orange ground above with a glaucous purple beneath. These, surrounding the shining scarlet bunches of berries, make the tree as beautiful an object at the close of autumn as it was in the opening of summer.

The Flowering Dogwood is of slow growth, and the wood is hard, heavy and solid, of a fine, close texture, and susceptible of a beautiful polish. It is often called box-wood, and is employed as its substitute, and for the handles of chisels, hammers, and other instruments, and for the cogs of wheels, and other articles made by the turner.

The bark is very bitter, with something of an aromatic taste. According to Dr. Bigelow, it acts on the human system as a tonic, an astringent and an antiseptic, approaching in its effects to the character of the Peruvian bark. For this it has been substituted and employed with great success in the treatment of intermittent and other fevers.

From the bark of the smaller roots the Indians obtained a good scarlet color. The smaller branches, stripped of their bark and used as a brush, are said to render the teeth extremely white.

SECTION THIRD.—*Plants with herbaceous stems, and flowers in an umbel-like cyme, surrounded by a petal-like involucre.*

Sp. 7. THE DWARF CORNEL. BUNCH BERRY. *C. Canadensis*. L.

Figured in Audubon's Birds, II, Plate 164.

A handsome, humble plant, growing in low, damp woods and in swamps, conspicuous in May and June for its showy, white flowers, and in autumn for its round bunches of red berries.

Stem simple, erect, or ascending, four to six inches high, from a creeping root, square, the membranous projection of the angles formed by the decurrent base of the leaves. Leaves opposite, in alternate pairs. Near the root they are thin, narrow, clasping, membranous. At the surface is a pair of bract-like, purplish, pointed scales, with veins of deeper purple, one quarter to half an inch long. Above is a larger pair, and at the top is a pair still larger, in whose axils are two pairs of smaller leaves. All these upper ones are nearly sessile, rhomboidal, tapering rapidly to a point at each extremity, entire, ribbed or veined, somewhat hairy above, shining and of a lighter green beneath. Flowers numerous, very small, in a terminal umbel, surrounded by four, white, roundish, rhomboidal, or broad-ovate, pointed, nearly sessile, expanded bracts, resembling petals. Calyx with four, minute teeth. Corolla with four, oblong, pointed, revolute segments. Stamens four, diverging, bearing white anthers. Style as long as the stamens, purple, surrounded by a dark purple disk. The scarlet berries are well known to children, being pleasant, but without much taste. They are sometimes made into puddings. But their chief value is to the birds, as they seem not to be affected by the frost, and remain on the stem into the winter.

FAMILY XXIII. THE WITCH HAZEL FAMILY. *HAMAMELACEÆ*. LINDLEY.

A family embracing shrubs of Madagascar, Japan, the Cape of Good Hope, China, and North America; an iron-wooded tree of Persia and the Caucasus; a poplar-like tree of India, and a tree with the aspect of a cherry-tree, of Assam. Alternate, deciduous feather-veined leaves; a bark often sprinkled with stellate pubescence; deciduous stipules; small axillary, or terminal white or pale yellow flowers; a calyx four- or five-cleft; petals sometimes wanting, sometimes four or five, spirally convolute in the bud, alternate with the calyx-segments, linear, deciduous; eight or ten stamens, four or five fertile, alternate with the petals, with anthers opening with a valve sometimes deciduous, four or five scale-like and sterile, (perhaps petals); ovary, adhering to the calyx, two-celled, with usually solitary seeds, and two styles; a leathery or woody, two-beaked, two-celled capsule, are its characteristics. A single American genus, *Fothergilla*, wanting petals, has fragrant flowers, with numerous fertile stamens. Properties unknown. There is a single genus in Massachusetts.

THE WITCH-HAZEL. *HAMAMELIS*. L.

Involucre three-leaved, three-flowered. Calyx deeply four-parted, invested with two to four roundish scales. Petals four, linear; stamens four, alternate with the petals; anthers opening with a lid; scales four, opposite the stamens; capsule woody, two-horned, with one black, shining seed in each of the two cells, opening at top by two elastic valves. Flowers sterile or fertile on one or different plants.

THE COMMON WITCH-HAZEL. *H. Virginiana*. L.

Figured in Barton's Flora, III, Plate 78. Catesby's Birds, Plate 102.

"The variegated appearance of the American forests during the months of autumn," says Dr. Bigelow, Fl. 61, "has been repeatedly noticed by travellers. Among the crimson and yel-

low hues of the falling leaves there is no more remarkable object than the witch-hazel, in the moment of parting with its foliage, putting forth a profusion of gaudy, yellow blossoms, and giving to November the counterfeited appearance of spring. It is a bushy tree, sending up a number of oblique trunks, about the size of a man's arm or larger."

The union, on the same individual plant, of blossoms, fading leaves, and ripe fruits, not very common in any climate, and occurring in no other instance in ours, led Linnaeus to give to this American plant, a Greek name significant of the fact of its producing "flowers together with the fruit."

The witch-hazel is usually found within or on the borders of moist woods, or among the scattered trees and shrubs which often clothe the steep banks of small streams. It rises to the height of from ten to twenty feet. In Essex woods, Mr. Oakes pointed out to me one which exceeded twenty-two feet, and was ten inches in circumference. The stem, which is seldom erect, is covered with a brownish, ash-colored, rather smooth bark; the branchlets of a lighter brown, with orange dots. The branches are long and pliant, with an upward curvature. The secondary branches are regularly alternate and lateral, those at the distance of one third its length from the end of a branch being longest. The leaves are lateral and alternate, or collected in tufts on the ends of the branches. They are on very short foot-stalks; irregularly obovate or rhomboidal, inequilateral, the lower side larger, lower on the stalk and half-heart-shaped, the upper side narrower, and rounded or wedge-shaped at base; acuminate, irregularly toothed or sinuate, the four or five principal veins on each side forming large teeth, downy, at last smooth above, with a ferruginous, stellate pubescence on the mid-rib, footstalk and veins beneath, the upper surface a dull green, the lower brighter and more shining. Stipules lanceolate, acute, coriaceous, half as long as the foot-stalk, which is one fourth or one third as long as the leaf. At the time when the flowers are expanding, the leaves become of a delicate leather yellow.

The flower-buds are already formed in August. The flowers expand, sometimes as early as September, or as late as

April, but usually in October or November, and stand, three or four together, nodding on the end of a brown, downy footstalk, one quarter or one third of an inch long, in the axil of the falling or fallen leaf, from an involucre of three to five, round, concave, russet, downy scales. Each flower is supported by a single, dark brown, ovate scale, like the scale of a bud. Within this are two or three similar scales or bracts, surrounding the calyx. The calyx is divided into four segments, russet and downy without, and yellow within, ovate, rounded and ciliate. There are four, long, linear, crumpled, yellow petals, at whose base, within, are short, incurved, yellow scales. Alternate with these are the four fertile stamens, curved inwards, and with their anthers projecting on each side like wings, and opening by lids. From the centre diverge two short, slender styles, surmounting the downy, ovate ovary. The fruit is a double nut, invested, below the middle, by the persistent, swollen, four-parted calyx. The capsular covering bursts elastically in two, disclosing the two nuts covered with shining, blackish, crustaceous shells.

The wood is white, flexible, and of a fine, close texture. The bark has the reputation of having efficacy in allaying pain, and is said to have been applied by the native Indians for that purpose, to tumors and inflamed surfaces. They also applied a poultice of the inner bark to remove inflammation of the eyes.

It is found in moist woods, from Canada to Louisiana.

As it produces flowers late in autumn and even in winter, it is deserving of cultivation. It may be propagated by layers or by seed, and it will grow readily in any tolerable soil, in a somewhat moist situation.

FAMILY XXIV. THE CURRANT FAMILY. *GROSSULACEÆ*.

DE CANDOLLE.

This family includes only one genus, which comprehends the Currants and the Gooseberries. They are either spiny or unarmed shrubs, natives of the mountains, hills, woods and thickets of the temperate regions of America, Europe and Asia, but unknown within the tropics, or in any part of Africa. They are found particularly about mountains. Most of the species produce agreeable, refreshing, sub-acid fruits. The Black Currant, *Ribes nigrum*, a native of Siberia and northern Europe, is cultivated for the pleasant tonic and stimulant properties possessed by a jelly made of its ripe fruit. The Red Currant, *Ribes rubrum*, found wild in the mountainous woods of Britain and other northern countries of Europe, and in the northern part of America, and the White, which is a variety produced from this by cultivation, are, in most places, justly valued for their uses in cookery, as a dessert, and as affording a cooling and wholesome drink. The common Gooseberry, *R. uva crispa* or *grossularia*, a native of the same regions, but hardly known in gardens on the continent of Europe, while the size and richness of its fruit are the pride of English, especially Lancashire horticulture, is generally but rather unsuccessfully cultivated here for its use in tarts and pies, and sometimes as a dessert. The Missouri Currant, *R. aureum*, has been introduced on account of the luxuriance of its growth and the beauty and fragrance of the flowers; and another from California, *R. speciosum*, which has been erected into the genus *Robsonia*, deserves to be introduced.

Fifty-three distinct species are described by De Candolle:—*Prodromus*, III, 477—483; sixty-six in Don's *Gardening*, III, 177—192; twenty-eight in the *Flora* of North America, I, 544—553, as natives of this country, several of which latter are not mentioned by the writers above-named.

Characters of the Family and of the Genus.—Calyx adhering to the ovary, bell-shaped or tubular, colored, marcescent,

5- (rarely 4-) cleft; at length spreading or reflexed. Petals distinct, small, alternate with the segments of the calyx, and growing from its throat. Stamens alternate with the petals; anthers turned inwards. Ovary 1-celled, with numerous ovules. Styles 2, (very rarely 3 or 4,) distinct or united. Fruit a berry, crowned with the remains of the flower, 1-celled, many-seeded. Seeds suspended by long threads. Embryo minute, situated in the sharper extremity. Leaves alternate, palmately veined and lobed, without stipules, sometimes sprinkled with resinous dots. Flowers in racemes.—*Flora* of N. A., I, 544. D C., *Prodromus*, III, 477.

There are four species of gooseberry and two of currant found native in Massachusetts, of which the specific characters are taken, with slight changes, from the N. A. Flora, as I have not been able sufficiently to study and compare the species for myself.

Sp. 1. THE PRICKLY GOOSEBERRY. *R. cynósbati*. L.

Stems either unarmed or prickly; sub-axillary spines 1—3; leaves cordate, roundish, 3—5-lobed, more or less pubescent, the lobes cut-serrate; racemes few-flowered, the pedicels divaricate; tube of the calyx cylindrical, very broad and short, slightly contracted at the mouth; the segments reflexed; stamens and style slightly included; style undivided, hairy at base; fruit prickly or rarely unarmed.—*Flora*, N. A. 546. *Bigelow*, 91. D C., III, 479.

Woods and hill-sides from Hudson's Bay to Kentucky, and west to the Rocky Mountains, and near the sources of the Platte.—*Fl.*

Sp. 2. THE COMMON WILD GOOSEBERRY. *R. hirtéllum*. Michaux.

Stems prickly or naked; sub-axillary spines usually solitary and very short; leaves roundish, cordate, 3—5-lobed, toothed, pubescent beneath; peduncles very short, deflexed, 1—3-flowered; calyx-tube bell-shaped, smooth, hairy at the throat within; the segments twice the length of the petals, nearly equalling the stamens and 2-cleft hairy style; fruit smooth.—*Flora*, N. A., R. triflorum, *Bigelow*, 90.

The recent shoots are green, shining, brownish or ashen, afterwards, when older, dark purple, the cuticle peeling off and leaving the stem unarmed. Usually 3 prickles are found at the base of each leaf.

Found in rocky places from Hudson's Bay to Massachusetts, and west to Lake Superior.—*Fl.*

Sp. 3. THE ROUND-LEAVED GOOSEBERRY. *R. rotundifolium*. L.

Stem not prickly; sub-axillary spines short, usually solitary; leaves roundish, 5-lobed, nearly glabrous, shining above; the lobes short and obtuse, incisely toothed; fruit-stalks slender, 1—2-flowered, glabrous; calyx cylindrical and narrow, glabrous, as well as the ovary; the segments linear-oblong, a little spreading, twice the length of the tube; filaments projecting, glabrous, twice or thrice the length of the broadly spatulate, unguiculate petals; anthers roundish; style deeply 2-parted, as long as the stamens, hairy below; fruit small, smooth.—*Flora*, N. A., I, 547,

Flowers in June. A shrub 3 or 4 feet high, with spreading, recurved branches; the spines occasionally absent. Leaves small, truncate or slightly cordate or often a little cuneiform at the base; the lower surface, as well as the short petioles, often somewhat pubescent. Fruit about the size of the black currant, at length purple, delicious.—*Flora*, N. A.

No native gooseberry promises so much as this. The introduced species often refuses to flourish in our gardens, even with careful cultivation. It is not perfectly adapted to our soil and climate. But this native one is, and if the art of cultivation can make as great a difference in it as has been made in the wild European gooseberry, the fruit will be the finest of the kind in the world. The cultivated species, on its cold, northern, native mountains, is small, hard, hairy and acerb. Cultivation points at its large, beautiful, firm, sweet, delicious fruit, as the triumph of art. This change has been produced by long and careful culture. What may not be made, by similar efforts, of a fruit perfectly suited to our climate, which, in its natural state, is pronounced delicious!

Found in mountainous and rocky places from Massachusetts to the mountains of North Carolina, and west to beyond the Rocky Mountains.

Sp. 4. THE SWAMP GOOSEBERRY. *R. lacustre*. Poiret.

Young stems very prickly; sub-axillary spines several, weak; leaves cordate, 3—5-parted; the lobes deeply incised; racemes 5—9-flowered, loose; calyx rotate; stamens about the length of the petals; style short, glabrous, 2-cleft; ovary glandular, hairy; fruit small, hispid.—*Flora*, N. A.

In mountain swamps. Flowers in June. Stems 3 or 4 feet high. Petioles

hairy. Peduncles slender, nodding, pubescent. Fruit dark purple, unpleasant to the taste. This species differs from the other native gooseberries in its many-flowered racemes.—*Flora*.

Dr. Bigelow describes it as a handsome shrub with dissected leaves. The older branches are smooth, with one or more deflexed, axillary spines. Young branches hispid, with small, reflexed prickles. Petioles slender, villous, with scattered hairs. Leaves deeply 5-lobed; the lobes cut and toothed like those of some geraniums.—*Florula*, 91.

Striking for its very deeply cut leaves.

Found in mountainous swamps from New York and Massachusetts, north to near the Arctic circle; and in the mountains of Oregon and California.—*Flora*.

Sp. 5. THE LARGE-FLOWERING CURRANT. *R. flóridum*. L'Héritier.

Leaves sprinkled on both sides with resinous dots, sharply 3—5-lobed, subcordate; the lobes acute, doubly serrate; racemes pendulous, pubescent; bracts linear, longer than the pedicels; calyx tubular-bell-shaped, glabrous; the segments oblong-spatulate, about the length of the tube; style undivided; fruit ovoid-globose, black, glabrous.—*Flora*, N. A., I, 549.

Dr. Bigelow says of it: This is a common wild currant, having its leaves generally in five lobes, toothed at the edge and covered on both surfaces with small, whitish, glandular points, just visible to the naked eye. Petioles fringed with compound hairs. Racemes pendulous, downy, many-flowered. Calyx tubular-campanulate, with recurved segments. Petals greenish-white, straight, a little reflexed at point. Fruit black, watery and insipid. Woods. May.—*Florula*, 90.

Found in woods from Canada, in latitude 54°, to Virginia and Kentucky.—*Flora*.

Sp. 6. THE MOUNTAIN CURRANT. *R. prostrátum*. L'Heritier.

Stems reclined; leaves deeply cordate, glabrous, 5—7-lobed; the lobes somewhat ovate, acute, incisely doubly serrate; racemes erect, slender; bracts small, much shorter than the bristly, glandular pedicels; calyx rotate, the segments obovate; style deeply 2-cleft; petals spatulate, very small; ovaries and fruit clothed with glandular bristles; fruit roundish, red.—*Flora*, N. A. 549.

Dr. Bigelow describes it: Stem procumbent, rooting. Leaves mostly five-lobed, toothed, smooth on both sides, the veins of the younger ones pubescent beneath. Racemes erect, the peduncles and germ covered with glandular hairs. Calyx hemispherical, the segments patulous, greenish with purple striæ. Petals wedge-shaped, shorter than the calyx. Stamens converging, anthers black. Style as long as the stamens, bifid. Berries hairy.

The berries when bruised have the odor of Skunk's Cabbage.—*Flora*, 90.

Found on hills and rocky places from Newfoundland, and throughout Canada, from latitude 57°, to Pennsylvania, and west to Lake Superior and the Rocky Mountains.—*Flora*.

FAMILY XXV. THE CACTUS FAMILY. CACTACEÆ.

Perennial, shrub-like or arborescent plants, of peculiar appearance and structure. The root is woody and fibrous. The trunk hemispherical, or cylindrical, branched or jointed, angular, ribbed, winged, or with mammillary projections, or plane;—fleshy, with a thick, mostly green, smooth bark, and interspersed with few or numerous woody fibres. The leaves are usually wanting and their place supplied by bundles of thorns. The flowers, often large, splendid and fragrant, consist of a calyx of many divisions, partly colored and petal-like, proceeding from the exterior of the ovary and passing by imperceptible gradations into the petals, which are very numerous, and arranged spirally or in several series. Within these, and, like them, proceeding from the lining of the calyx-tube, are the numerous, slender stamens. The base of the calyx is the 1-celled ovary, containing a great number of ovules attached to seed-nourishing projections from the walls. The style is single, and terminates in 3 or more stigmas. The fruit is a fleshy, umbilicated berry, in the pulp of which the numerous seeds, enclosed in a double integument, nestle. The fruit is pleasantly acidulous, eatable, and, in its native tropical climates, grateful.

De Candolle enumerates about 180 species, all indigenous to America, and most of them to the warmest regions, where they delight in warm, arid situations, exposed to the sun. Some species have been perfectly naturalized on the coast of the Mediterranean, and many are cultivated in conservatories, for their singularity or the extreme beauty of their flowers. A species of cactus is sometimes used in the south of Europe as a hedge. Another species, *Opuntia coccinillifera*, a native of Mexico, sustains the cochineal insect, from which is obtained the beautiful scarlet of such importance in commerce.

Some species are found on the sandy wastes at the foot of the Rocky Mountains. A single species occurs in Massachusetts.

THE INDIAN FIG. *OPUNTIA*. Tournefort.

Shrubby plants with articulated branches; the joints mostly compressed and dilated, bearing fascicles of prickles or bristles, arranged in a quincuncial or spiral order. Flowers, yellow or red, sessile, arising from the clusters of prickles, or along the margin of the joints. Stamens numerous, shorter than the petals, somewhat irritable. Berry tuberculate, often prickly, eatable.—*Flora of N. A.* Five species of this genus are found north of Mexico.

THE PRICKLY PEAR. *O. vulgàris*. Miller.

An erect, or prostrate, creeping plant, with articulated stem, the joints from two to four inches long, very fleshy and armed with tufts of setaceous spines. The flowers are large and grow from the margin of the joints. Petals bright yellow, obovate, mucronate, much longer than the calyx. The fruit is obovate, pulpy and edible; the seeds numerous, small, immersed in the crimson pulp.

My friend Thomas A. Greene informs me that he found this plant growing plentifully at Coatue Point, a long, narrow promontory extending towards Nantucket Harbor from the east, and accessible only at low water or in a boat. It was so near the water's edge that it must have sometimes been overflowed by the sea. "It was found early in July, and was then in full flower. From its succulent qualities, it remained fresh, and continued to put forth flowers for a long time, though thrown carelessly by in the door-yard. One of the plants, after lying thus for many days, was transplanted to James Arnold's garden and continued to live several years."

Nantucket is in north latitude $41^{\circ} 16'$, and this is the most northerly point on the Atlantic coast, at which a cactaceous plant is found growing naturally. Mr. Greene has seen the same species growing in thin soil on the rocky ledges of Manhattan (New York) Island, and it is said to be found at New Haven, in Connecticut. It is found also in New Jersey, and thence to Florida.

FAMILY XXVI. THE ROSE FAMILY. *ROSA'CEÆ*. JUSSIEU.

This family includes herbaceous plants or shrubs with simple or compound, alternate, serrate leaves, having 2 stipules at the base of each. It embraces the true Roses, from whence its name, the Brambles, Cinquefoils, Strawberries, Spiræas, and numerous other plants of a similar character.

The flowers are regular and showy, white, red, or yellow, and usually disposed in cymes or corymbs. The calyx has 4, or, more frequently, 5 divisions; the corolla has as many petals,—rarely none,—alternate with the divisions of the calyx, and inserted on the edge of the disk which lines the calyx-tube; the stamens are distinct, numerous, usually some multiple of the petals, and inserted just below them; fruit various.

They are chiefly confined to the temperate or cold climates of the northern hemisphere, very few being found in any other part of the world. No rosaceous plant is poisonous, and many species, particularly the Blackberry, Raspberry and Strawberry, furnish wholesome and delicious fruit. They are remarkable for possessing an astringent principle, which gives to some of the species a value to the tanner, and renders many others useful in medicine for their tonic effect, and as remedies in fever. The roots of more than one species of blackberry are well known as valuable popular medicine in diseases affecting the digestive organs. The leaves of the sweet briar and of a species of bramble have been substituted for tea, or used to adulterate tea. Under cultivation, and indeed in a wild state, plants of this family are remarkable for the varieties of form they assume, so that the species run into and are confounded with each other. Many of them, especially the roses, are particularly liable to the attacks of insects.

As an ornamental plant, the rose has been longer and more deservedly celebrated and valued than any other; and for the beauty and fragrance of its flowers it has still no rival.

The family is divided into several tribes.

1. THE SPIRÆA TRIBE, *SPIRÆA*, in which the fruit is a dry seed-vessel or follicle.

THE HARD HACK. *SPIRÆA*. L.

The spiræas are shrubs, or herbs from perennial roots, with alternate leaves, and white or rose-colored flowers, which are formed of a 5-cleft, persistent calyx; 5 equal petals; from 10 to 60 stamens; 5, rarely 3 or 12, ovaries, which become so many 1-celled follicles, distinct or rarely united at base, and containing from 1 to 15 seeds. There are about fifty species of this genus, many of which are hardy plants of great beauty, cultivated extensively in the gardens of Europe, and sometimes formed into hedges. The different species flower successively from spring to the end of summer. They are propagated by dividing the roots, by suckers, by layers or by seed. The root and bark generally possess astringent and tonic properties, and are employed in medicine and in tanning. Thirteen species are found in North America, of which the following occur here.

Sp. 1. THE NINE BARK. *S. opulifolia*. L.

An ornamental shrub from five to seven feet high, distinguished for the abundance of its showy heads of flowers, and for its conspicuous fruit. The stem is rugged, with loose, gray bark, easily detached and scaling off. The recent shoots are somewhat angular, and green. Leaves on short footstalks, ovate, rounded at the end, usually with two large lobes about or below the middle, but often entire, doubly serrate or crenate, the serratures rounded and callous. Stipules as long as the footstalk, oblong, pointed. Flowers in nearly hemispherical heads, on a short stalk. Each flower on a slender, downy thread. Calyx 5, broad, pointed lobes. Petals round, white, with a rose tinge. Stamens very numerous, long, with short, purple anthers.

It is found from Canada to Georgia and Missouri, and as far west as Oregon and California.

This showy plant may be made to grow any where, in wet ground or dry, by cuttings thrust almost without care into the ground.

I have not found it growing wild in this State, but as it is found north and south of us, it may hereafter be found here. It is much and deservedly cultivated as an ornamental plant.

Sp. 2. THE QUEEN OF THE MEADOWS. MEADOW SWEET.

S. salicifolia. L.

A smooth, slender, leafy shrub, from two to six feet high, abounding in wet, and rarely growing in dry places. Stem of a polished copper red, lighter above, closely set with leaves below, and terminating in a roundish head of white flowers. Leaves lanceolate or rarely obovate-lanceolate, usually acute at each extremity, sometimes obtuse, on a short and slender petiole, sharply, sometimes doubly serrate, of nearly the same color above and beneath, thin. The terminal panicle is crowded with single, close-set flowers above, and branches from the axils of the leaves below, each sustaining a roundish bunch of flowers. Partial flower-stalks, thread-like, with usually a slender bract at base. The segments of the calyx are acute; after flowering they shrivel up, leaving the cup encircling the seed-vessels. The petals are rounded, usually entire, white, rarely rose-tinted. The stamens are attached, in a single row, to the outer, swollen, glandular edge of the lining of the cup. This edge is rose-colored, and the white anthers have a faint tinge of the same color, giving, together, a rosy hue to the flower. The seed-vessels are formed of 5 carpels, united at base, and encircled by the persistent calyx-cup. They open from the top, by the middle suture. The dry heads of the opened seed-vessels are conspicuous, rising up among the flowers of the succeeding year. The perennial root is tough and strong, running for several feet, just below the surface. Flowering from July to September.

Several varieties are described by Pursh, and in the Flora of North America. The most common seems to be that called *paniculata* by Pursh, with considerable variations, particularly in the color of the stem and under surface of the leaf.

Sp. 3. THE STEEPLE BUSH. HARDHACK. *S. tomentosa*. L.

A leafy shrub, from two to five feet high, growing in wet ground, and distinguished, in the flowering season, for its long

tapering spire of purple flowers. The old stems are smooth and of a dark bronze color. The recent stems and every other part of the plant but the upper surface of the leaves, are covered with a thick, close down, of a light rust color, varying, on the lower surface of the leaves, to white. The leaves are very thick, crowded, on very short, rather stout petioles, elliptic or oval, somewhat obtuse, coarsely and unequally serrate. The lower part of the compound panicle is made up of partial ones from the axils of the leaves. Flowering begins at the top, where the flowers are faded before those on the lower branches begin to expand. Notwithstanding this defect, the plant possesses considerable beauty. The roots are large and running. Flowering from July to September.

This plant has valuable astringent qualities, and is employed as a tonic in dysentery and other disorders of the system, particularly in those incident to females.

Both of these species are deserving of cultivation for their beauty, their flowers coming on as the spring flowers are passing, and continuing into the autumn. Cultivation improves them; the dead stems of the previous year deforming, and the roots impeding the growth of the flourishing stocks.

2. THE BRAMBLE TRIBE, *DRYADEÆ*, in which the fruits are seed-like little nuts, or sometimes little drupes, and, when numerous, crowded on a conical or rounded receptacle,—contains, besides the Blackberry and Raspberry,—Cinquefoil, Agrimony, the Strawberry and others.

The BRAMBLES. *RUBUS*. The various species of the bramble and of the rose have been described in Prof. Dewey's Report on the Herbaceous Plants, and I should not mention them, but that this report may fall into the hands of some persons who have not seen the other, and, as these plants are half ligneous, it might seem incomplete without some notice of them.

The FLOWERING RASPBERRY, *R. odoratus*, is a low shrub, ornamenting the sides of roads and paths among mountains and in moist glens, in most parts of the State, and giving a charm to many a solitary spot by its large, rose-like flowers. The old stalk is dry and scaly; the recent shoots and flower branches green below, reddish above, with a covering of purple, gland-

bearing hairs, which continue up the footstalk and along the mid-rib and principal nerves, on the under surface of the leaf, and thickly invest the flower-stalk and calyx. Five principal nerves give the soft and woolly leaf 5 lobes, which have large, unequal teeth. The globular, unopened buds are crowned with a tassel from the 5 long points of the calyx. The flowering is what is called centrifugal, the bud at the end of the main stem opening first. The petals are 5, large, purple, crumpled, soon fading in the sunshine. The fruit is flattish, red, pleasant, though less agreeable than that of the true raspberry. It is much cultivated for its beauty. Should be planted in a shady place.

The wild RED RASPBERRY, *R. strigòsus*, not inferior to the cultivated, and very nearly like it, and the HIGH BLACKBERRY, *R. villòsus*, and *R. frondòsus*, and some varieties of the LOW BLACKBERRY, *R. Canadènsis*, of Torrey and Gray, are delicious and wholesome fruits. They differ much in different localities. This circumstance is worthy of consideration with those who mean to attempt to improve these fruits by cultivation. The variety of High Blackberry found at Fall River and around Buzzard's Bay, is superior to any that I have tasted, in the vicinity of Boston. And every one who has tasted, remembers the superior flavor of the wild Raspberry of Maine. The THIMBLEBERRY, *R. occidentàlis*, is an inferior fruit; but has been, in some instances, much improved by cultivation. The BRISTLY BLACKBERRY, *R. setòsus* of Bigelow, *R. hispidus* of T. and G., and *R. sempervirens* of Bigelow is of little interest.

3. THE ROSE TRIBE, *ROSEÆ*, in which numerous nut-like seeds cover the fleshy lining of the urn-shaped calyx-tube,—contains the true ROSES, *Rosa*, L., of which 144 distinct species are described by De Candolle.

Four species of wild rose are common in the eastern part of Massachusetts:—the EARLY WILD ROSE, *R. lùcida*, Ehrenberg, with very numerous varieties, found every where, mostly in dry places, and flowering in May and June; the SWAMP ROSE, *R. Carolìna*, L., coming in flower as the last goes out, and continuing into August; found rarely except in wet ground, and distinguished by the softness and paleness of its foliage; the

SHINING ROSE, *R. nitida*, Willdenow, distinguished for its shining, dark colored leaves and the extreme prickliness of its stem, found in a few places, in low grounds,—and the SWEET BRIAR, *R. rubiginosa*, with many varieties. The last was doubtless introduced, but has spread very extensively.

FAMILY XXVII. THE APPLE FAMILY. *POMACEÆ*. LINDLEY.

To this family belong only trees and shrubs with alternate, simple or compound leaves, stipules commonly deciduous, purplish, white, or pink flowers in terminal bunches, with a calyx of 5 divisions, a corolla of 5 petals, alternate with the divisions of the calyx; stamens numerous, some multiple of the petals, growing on and within the calyx; from 1 to 5 styles, and the fruit a pome or apple with from 1 to 5 cells.

The Pear, the Apple, the Quince, the Hawthorn, the Rowan Tree or Mountain Ash, and the Wild Sugar Pear, so valuable for their fruit and for the beauty and fragrance of their flowers, give an interest to this family with which few others can vie. The wood of all the species is of a close and smooth grain, and valuable to the turner. The fruit contains a peculiar vegetable acid called *malic acid*.

This family is almost confined to the northern temperate zone of both continents: few species are found in the southern hemisphere, and within the tropics they are found only on mountains or elevated plains.

XXVII. 1. THE THORN. *CRATÆGUS*. L.

Thorny shrubs or low trees, natives of Europe, India, and North America, with entire or variously lobed and cut leaves, deciduous. Stipules and flowers in terminal corymbs. The calyx-tube is pitcher-shaped; the petals spreading and roundish; the stamens many; the ovary with 2 to 5 cells, and surmounted by as many glabrous styles; the fruit a fleshy pome,

closed by the teeth of the calyx, and containing from 2 to 5 bony nuts, each with one seed.

Many of the most beautiful and highly valued thorns are natives of North America, and four, and probably others, of New England. Hence they have been carried to Europe, and have there, especially within a few years past, received great attention. It is found that a greater variety of beautiful small trees and ornamental shrubs can be formed of the several species of thorn than of any other kind of tree whatever. They thus give persons, whose grounds are not extensive, the means of ornamenting them with great facility. If trained as trees, they have an appearance of singular neatness united with a good degree of vigor. And the readiness with which they are pruned and grafted, renders them susceptible of almost any shape which the fancy of the owner would have them assume.

In his *Forest Scenery*, I, 94, Gilpin, speaking of the English hawthorn, after some depreciating remarks, adds, "In autumn, the hawthorn makes its best appearance. Its glowing berries produce a rich tint, which often adds great beauty to the corner of a wood, or the side of some crowded clump." In a more favorable tone his editor subjoins,—“We have seen it hanging over rocks, with deep shadows under its foliage, or shooting from their sides, in the most fantastic forms, as if to gaze at its image in the deep pool below. We have seen it growing under the shelter, though not under the shade, of some stately oak, embodying the idea of beauty protected by strength. We have seen it growing grandly on the green of the village school, the great object of general attraction to the young urchins, who played in idle groups about its roots, and perhaps the only thing remaining to be recognized, when the schoolboy returns as the man. We have seen its aged boughs overshadowing one half of some peaceful woodland cottage, its foliage half concealing the window, whence the sounds of happy content and cheerful mirth came forth. We know that lively season,

When the milkmaid singeth blythe,
And the mower whets his scythe,
And every shepherd tells his tale
Under the hawthorn in the dale.”

Some of the species native to Massachusetts often take, even in a state of nature, the shape of handsome low trees. Of these, the flowers and foliage have great beauty, and the scarlet haws, which remain on into the winter, till, ripened by the frosts, they are gathered by the birds, give them an additional charm. Into these tall species all the others, very various and many of them very beautiful, may be grafted. And not only thorns, but pears and other fruits, may be readily made to grow upon the thorn.

The wood of the thorn is of a yellowish white, heavy, close-grained, hard, and difficult to work. It is not of sufficient size for many useful purposes, and it is somewhat liable to warp. But its hardness and the beautiful polish it takes, make it particularly fit for the handles of hammers and other small tools, and for walking-sticks; and it is often used for wedges.

But by far the most important use of the thorn is for the formation of hedges. The fact that so large a number of thorn trees are natives of this State, and found flourishing in every dry situation, in almost all kinds of soil, shows that they may be used for this purpose, with as much certainty as in England or on the continent of Europe. The time has not yet come, and, in those parts which are full of stones, it may never come, when hedges will take the place of wood and of stone for enclosures, as entirely as they have in England. But in many situations, in every part of the State, they might, even now, be introduced with great advantage and great beauty. About country houses and gardens, where it is desirable to avoid the stiff appearance of close wooden enclosures, the roughness of stone, and the slovenliness of the straggling fence, a hedge of thorn is a most desirable substitute. The experiment has been successfully tried, in the vicinity of Boston, often enough to show its practicability and its advantages. And in such situations the hedge would answer the double purpose of a fence and a row of fruit and ornamental trees. Pears, apples and quinces might be grafted into the largest stocks, and the mountain ash, and the wild sugar pear, add their rich bunches of fruit in winter, and their graceful and rich flowers in early spring.

“When the hawthorn is to be raised from seed, the haws

should not be gathered till they are dead ripe. As many haws contain more than one seed, they ought not to be put in the ground entire, but, if they are to be sown immediately, they must be macerated in water till the pulp is separated from the nuts; and the latter should then be mixed with dry sand, to keep them separate, and to enable the sower to scatter them equally over the surface; they should be sown in November or December, as soon as separated from the pulp. They may be sown thinly in beds, the seeds being scattered so as to lie about one inch apart every way, and covered about a quarter of an inch. At the end of the first year's growth, the strongest of the plants may be thinned out from the beds, and planted in nursery lines; and in the autumn of the second year, the remaining plants may be taken up for the same purpose. Hawthorns ought always to be two years transplanted before they are employed for hedges; younger and untransplanted plants, though cheaper to purchase, are always the most expensive to the planter, as they require temporary protection for a longer period."—*Loudon*, II, 840.

When the pear is grafted into the thorn, it should be done close to the surface of the ground, or even beneath it, as otherwise there is danger of the trunk out-growing the root, and being blown over by the wind.

Sixteen species, according to Torrey and Gray, are found in North America. The following are found in Massachusetts:—

Sp. 1. THE COCKSPUR THORN. *C. crusgalli*. L.

This is a singularly neat shrub, often forming a beautiful, round-headed, small tree, ten or fifteen feet in height. The trunk is erect, with a rough, scaly bark, and set with sharp thorns. The branches are gray, numerous, large, nearly horizontal, and very thorny. Recent shoots of a reddish gray. The leaves are entire, inversely egg-shaped, tapering regularly from near the end to the base of the footstalk. They are rounded or pointed at the extremity, serrate, except towards the base, dark green, smooth and very shining above, paler, but smooth and conspicuously reticulated beneath.

The flowers are in irregular corymbs, with a leafy footstalk,

a leaf being below each of one or two of the lower partial footstalks. The calyx-segments are long and acute. Stamens usually 10, and styles 1 or 2. The fruit is on slender, somewhat branched stalks, dependent from the end of spurs which are shorter than the thorns, oblong-globose, dotted with brown, crowned with the 5 very acute segments of the calyx.

The thorns are two or three inches long, or more, very sharp and slender, and, when young, set with a few minute leaves. Several varieties of this thorn are found or produced by cultivation.

Found from Canada to Florida, and westward to Missouri.

Sp. 2. THE WHITE THORN. SCARLET-FRUITED THORN.

C. coccinea. L.

A low, round-headed, much branched tree, growing naturally on rather dry, rocky hills, but found by the banks of streams, and in all kinds of soil. When surrounded by other trees, it sometimes attains the height of twenty-five feet.

The trunk on old trees has a light gray, scaly bark, often rugged and knurly, and not unfrequently armed with stout thorns, especially between the lower branches. The recent branchlets are of a dark olive green, which gradually turns to a light gray. The thorns are long, pointed, and somewhat falcate, or short and stout, sometimes solitary, more frequently by the side of a short branch.

The leaves are of a soft, leathery texture, round-ovate, or rhomboid, or broad-elliptical, in their outline, often entire and usually wedge-shaped at base, or slightly decurrent into a slender footstalk; on the sterile branches often heart-shaped at base; serrate towards the end, and nearly entire or more or less deeply divided, on each side, into 2 to 4 acuminate lobes; smooth on both surfaces, dark green above, lighter beneath. Flowers in May or June. The segments of the calyx are glandular-dentate; the stamens often only 10; styles 3 to 5. The fruit is globose, or pear-shaped, half an inch long, one third of an inch broad, of a bright scarlet.

Found from Canada to Texas, and westward to Kentucky.

Sp. 3. THE PEAR-LEAVED THORN. *C. tomentosa*. L.

A much branched shrub usually eight or ten feet high, but, when surrounded by other plants, eighteen or twenty, with bark, on the branches and small trunks, of a bright reddish, polished green, or a shining brown, on the recent shoots dotted with elliptic, raised, brown dots. The thorns are axillary, from one to three inches long, and pointed. The flowers are large and fragrant, on broad, leafy corymbs. The segments of the calyx are long and slender and glandular-serrate, and, with the flower-stem, downy. The styles are usually 3. The fruit is large, orange red, pear-shaped.

The leaves are of a firm, leathery texture, rather deeply furrowed on the upper surface, large, sometimes five inches in length and three in breadth; ovoid, tapering rapidly at base into a footstalk which is margined to the bottom; doubly serrate, sharply cut towards the extremity, which commonly ends in an acute point; downy on both surfaces when young, smooth finally on the upper surface, but with the veins beneath permanently covered with a short down.

This is one of our most common and hardy thorns. It is well fitted to form a part of a hedge, but is objectionable on account of the early fall of the leaf. It should, therefore, be mingled with sweet-briar and the buck-thorn.

It flowers in May and June, and ripens its large fruit in October. Found from Canada to Kentucky.

Sp. 4. THE DOTTED-FRUITED THORN. *C. punctata*. Jacquin.

A handsome shrub, eight to twelve feet high, rarely more, but sometimes twenty or even twenty-five. The trunk, sometimes straight, is usually contorted and zig-zag, covered with a rough, much fissured bark.

The recent shoots have the dark brown, polished bark, characteristic of the thorn; the older branches are of a greenish gray, smooth or channelled with many small grooves. Thorns commonly long and stout, scythe-shaped. Leaves inversely egg-shaped, rounded towards the extremity, and wedge-shaped at base, tapering downwards and running along in a wing upon

the footstalk, almost to its very base. They are doubly serrate above, sometimes deeply cut towards the end, of a rather firm and tough texture, with furrows above the nerves on the upper surface, lighter colored and sometimes hairy beneath, especially on the veins. The fruit dark scarlet, rounded or egg-shaped, dotted with grayish dots, on footstalks which are dotted and hairy, branching, forming corymbs or heads with leaves beneath several of the lowermost footstalks. The fruit is somewhat hard and tough, but eatable and rather agreeable to the taste.

. This, like several other thorns, produces a great abundance of fruit. It is ripe in September, and a small tree loaded with it continues a very beautiful object, conspicuous at some distance, for several weeks. Each haw usually contains two pretty large hemispherical stones or nuts, so that a single tree often yields seed enough to produce plants sufficient for fifteen or twenty rods of hedge.

It is found, though less frequently than the white thorn, in most parts of the State, and in all situations, except, I think, very wet ground.

These four species, with many varieties, especially on the White and the Dotted-fruited, are all I have found in the State, though probably others are to be found. They would seem to promise better than any foreign species, for all the purposes to which the thorn may be applied.

One of the foreign species, the English Hawthorn, *C. oxyacantha*, distinguished for its deeply 3- or 5-lobed leaves and often purplish blossoms, has been somewhat extensively introduced, and flourishes perfectly well.

XXVII. 2. THE PEAR. *PYRUS*. Lindley.

A genus containing trees or shrubs with simple or compound, serrate leaves; spreading, terminal, simple or compound cymes of white or rose-colored flowers, with awl-shaped, deciduous bracts; and fruit for the most part eatable. The calyx-tube is pitcher-shaped; the petals are roundish; styles 5, rarely 2 or 3, distinct or somewhat united at base; pome fleshy or berry-like, 5- (rarely 2- or 3-) celled, with 2 seeds in each cell.

The Apple, the Pear, the Service, the Beam-tree and the Mountain Ash, besides several less important plants, belong to this genus.

The PEAR TREE, *P. communis*, is too well known to need a description, and several writers have given directions for its cultivation in this climate. It grows rapidly and forms a tall and finely shaped head; the fruit is agreeable and wholesome as food, and the juice forms a pleasant liquor; and it is to be regretted that this tree is not more frequently planted. Rows of the pear tree might often border road-sides and divisions of lands, with little injury to the grass or other vegetation, and to the great relief of travellers, and the protection of orchards and gardens.

There are few in any community, certainly in ours, so lost to a sense of right, and so insensible of gratitude, as to desire to make depredations on the property of their neighbors, when their hunger may be appeased, and their taste gratified, by the fruit of trees standing by the road-side. And how much enjoyment would be given to that class, always to be found, in every country, who have no fruit trees of their own, by planting a number of such trees, in every village, and along every public road, for the very purpose of being, and being considered, public property! A more effectual and benevolent way of protecting valuable fruit trees, and preventing depredations, cannot easily be devised. On this point, Gerard, a quaint but earnest old writer upon plants, uses an exhortation, the spirit of which we hope many may be ready to adopt. "Forward," says he, "in the name of God, grafte, set, plant and nourish up trees in every corner of your ground; the labor is small, the cost is nothing; the commodity is great; yourselves shall have plenty; the poor shall have somewhat in time of want, to relieve their necessity; and God shall reward your goode mindes and diligence.—(*Herbal*, p. 1459.) Loudon says he was much struck with the lines of fruit trees which bordered all the public roads in the south of Germany, the apples and pears being bent almost to the ground with their loads of fruit.

The wood of the pear is of a reddish white color, heavy, firm,

of a very fine and close grain, and next to box for the use of the engraver on wood. It takes a fine and permanent black stain, and can then with difficulty be distinguished from ebony, so that it is sometimes substituted for it. It is tough, not liable to warp, and fitted for the use of the turner and for the manufacture of tools. As fuel, it burns readily and vividly, and yields a great heat. The leaves and the bark afford a yellow dye.

The number of names of pears contained in the London Horticultural Society's Catalogue for 1831, was 677.—(*Loudon*, p. 883). All these, it must be remarked, are varieties of a single species, the common pear, and yet all are distinguishable by the qualities of the fruit, and oftentimes by peculiarities in their leaves, modes of growth, color and appearance.

The APPLE, *P. málus*, is still more valuable, in every respect, than the pear, but does not form so handsome a tree. It has been longer and more carefully cultivated than any other tree, and the effects of cultivation are visible in the immense number of varieties, and in the prodigious difference between the delicious qualities of some of the choicer sorts, and the harsh, sour, and austere crab-apple, produced by the same tree growing wild. It is native to all the temperate parts of Europe and Asia, and is every where cultivated for its fruit.

The apple flourishes in every part of New England, though, like the pear and the peach, it is liable to great fluctuations from year to year. Many people think that all these species, especially in their tender varieties, are less successfully cultivated than formerly. The change is probably not greater than is to be ascribed to the loss or diminution of the forests. The last two or three years seem to be bringing back the olden time, and make it probable that the apparent decline of some previous years is only part of a cycle, which, when completed, will bring round again the seasons most favorable to these valuable fruits. The climate seems to be subject to some such periodical change. Old and valuable varieties of this fruit and of the pear are continually dying out, and alarm is sometimes felt lest none so good shall be found to take their place. But the arts of the fruit-cultivator were never in so high a state as at this moment ;

in 1836, the catalogue and the gardens of the London Horticultural Society, contained upwards of 1400 distinct sorts, (*London*, p. 895,) and new ones are every year added.

The fruit is not only delicious and wholesome to man, either unprepared, or in the numerous forms into which it is reduced by the culinary art, but it forms a very valuable and nutritious article of food to almost all quadrupeds.

The wood of the apple tree is of a reddish or brownish color, smooth, fine-grained, and hard, but rather light. It is much used by the turner, and often made into walking-sticks. It has been found very durable when used as cogs of wheels. On account of its smoothness and hardness, it is used to make shuttles and reeds for weaving.

The apple tree is often found growing in the forest, rising to a far greater height than when in the orchard. Stocks have been pointed out to me more than seventy feet high.

In the southern country, a small native apple tree is found, the *Pyrus coronaria*, growing rarely to the height of twenty feet, bearing large, fragrant, rose-colored flowers, succeeded by small fruit. In the Middle States occurs another, *P. angustifolia*, with leaves and fruit smaller.

THE AMERICAN MOUNTAIN ASH. *P. Americana*. De Candolle.

The mountain ash is found growing abundantly about Wachusett, and in several other mountainous situations in Massachusetts, and also in low, cold, moist plains in Maine. It often grows in bunches. The trunk rarely erect, but ascending, and from fifteen to twenty-five feet high. Its branches are few, solitary, and making a sharp angle with the stem. The bark is of a bright bottle green on the new shoots, growing darker on the older. The leaves are in tufts on the ends of the branches, pinnate, usually of seven pairs of leaflets and an odd one. The petiole is dark red. The leaflets are oblong-lanceolate, unequal at base, rounded or cordate on the lower, acute on the upper side, equally and deeply serrated, with numerous parallel nerves. The color is a soft green, paler beneath. The flowers, which expand early in June, are white; the fruit, which, like that of

the cultivated Mountain Ash of Europe, *P. aucupària*, when planted about houses, remains on during the winter, is of a dark reddish or scarlet color.

It has a strong resemblance to the imported mountain ash, but may be distinguished by its leaves and their petiole being more smooth, the bark darker, and its habit more slender. Its fruit, also, is of a darker color. When cultivated in England, it assumes a more robust appearance than the European mountain ash, so that its slender form, when growing wild, might be thought to be owing to its being drawn up by being surrounded by other trees. It has, however, the same delicate shape when exposed to the winds on the north side of the Wachusett.

From the resemblance to the European tree, so great that Michaux supposed it might be a variety, it is probable that its cultivation should be the same.

That tree is commonly raised, in England, where it is much cultivated as an ornamental tree, from the seed, which is gathered as soon as ripe, macerated in water till the seeds are separated from the pulp, and then may be immediately sown. They will, in that case, remain eighteen months in the ground before coming up. It is common, therefore, to mix the berries with light, sandy soil, and spread them in a layer, of ten or twelve inches in thickness, in the rotting ground, covering the layer with two or three inches of sand or ashes, and allowing them to remain in that state a year. They are then separated from the soil by sifting, and sown in beds of light, rich soil, being covered a quarter of an inch. This should be done as late as possible in the fall. They will come up in June, and by the end of the season some of the plants will be eighteen inches high, and ready to transplant to the nursery. The seeds should be not less than two inches apart.—*Loudon, Arb.*, 920.

The European Mountain Ash is commonly known in England by the name of Rowan or Roan Tree, and, in some districts, Witchen; and has long been considered of sovereign power against witches and evil spirits, and all their fascinations and spells. For this purpose, it was made into walking-sticks, or branches of it were hung about the house or about stables

and cow-houses. In a stanza of an ancient song, quoted by the author of "Sylvan Sketches," we have

"Their spells were vain ; the hags returned
To the queen in sorrowful mood,
Crying that witches have no power
Where there is roan-tree wood."

She adds,—" This last line leads to the true reading of a line in Shakespeare's tragedy of Macbeth. The sailor's wife, on the witches requesting some chestnuts, hastily answers, 'A rown-tree, witch!' but all the editions have 'Aroint thee, witch!' which is nonsense and evidently a corruption."

As the rowan-tree grows freely in the most exposed situations, it is often planted, as a nurse to young trees of slow growth exposed to the sea-breeze, and it has the great advantage of not growing above a certain height, so that when it has performed its office, it does not interfere with the growth of the oaks and other trees for whose benefit it has been planted. It flourishes best in a good moist soil in an airy exposure.

Another tree, nearly resembling our Mountain Ash, and perhaps a variety, is found in the Middle States, and called the Small-fruited Mountain Ash.

Several trees of this kind belong to Europe, some of which might be a valuable acquisition, for ornament, at least, to our gardens, particularly the True Service Tree, *P. sorbus*, which is remarkable for its wood being the hardest and heaviest of the indigenous woods of Europe.

The fruit of the Mountain Ash is rather sour to the taste. It abounds in malic acid, and the juice has been used for the purpose of turning cider to vinegar.

Sp. 2. THE CHOKE-BERRY. *P. arbutifolia*. Willdenow.

This is a slender, branching shrub, two to five feet high, with a grayish brown stem and whitish or reddish green, downy shoots. The leaves are one or two inches long, and half as wide as long, lance-oblong, or elliptic, oval, or obovate, tapering at base, finely and sharply serrate, with the serratures ending in a callous point, often tapering to a short point, pale and usually downy beneath when young, but becoming afterwards

smooth, and of a rich, glossy, deep green above, with small, dark, purple glands on the mid-rib. Flowers white with sometimes a slight rosy or purplish tinge, in terminal, compound, downy corymbs. Partial flower-stalks hairy, with slender, deciduous bracts at base. Calyx downy, segments acute, with minute glands on the edge. Petals roundish, often emarginate, concave. Filaments white, anthers purple. Ovaries 5, woolly, united at base; styles smooth, straight. Stigmas capitate. Fruit a pome with 5 cells and 10 seeds, of the size of a whortleberry, often downy, sometimes shining, dark red or reddish purple, rather dry, astringent, and sweetish to the taste.

This is abundantly found in moist, open woods, or in dry, shady woods, or along their border, and makes a handsome appearance, in little clumps, with its bunches of flowers, in May and June, and its erect, purple fruit, in autumn. If cultivated, it would probably increase in all its proportions, and would certainly form a very ornamental little shrub.

A finer and larger variety of this plant sometimes occurs, and, in certain places along the sides of wet woods, is more common than the one just described. This has been considered by Willdenow, and, after him, by Pursh, as a separate species, under the name of *P. melanocarpa*. There is little difference in the flowers or foliage, the latter being, however, in every part, a smoother plant. The fruit is larger, in a closer corymb, much more juicy and agreeable to the taste, and of a shining black color. It is, probably, only a variety, as individual plants occur more or less distantly removed from these two extremes, and of which it would be difficult to say to which they should be considered as belonging.

XXVII. 3. THE WILD SUGAR PEAR. *AMELANCHIER*. Medic.

Small trees, with simple, serrate, deciduous leaves, white, racemed flowers, and linear-lanceolate, deciduous bracts, distinguished by obovate-oblong or lanceolate petals; stamens rather shorter than the calyx; ovary with 10 (or 5 bipartite) cells, each containing a solitary ovule; 5 styles partially united at base; pome, when matured, with 3—5 cells, and 3—5 seeds.

A genus of three or four species, two of them European, and one, with very numerous and marked varieties, American.

THE SHAD BUSH. SWAMP PYRUS. *A. Canadensis*. Torrey
and Gray.

Figured in Audubon's Birds, I, Plate 60.

There are two remarkably distinct varieties of this species found in Massachusetts. Both are called the Shad Bush, from flowering when the shad begin to ascend the streams. The first is also called

The JUNE BERRY. *A. botrydium*. This is a small, graceful tree, from fifteen to twenty-five, sometimes thirty feet high, with a few, slender, distant branches, usually growing in upland woods. The bark is of a reddish green; that of the branches and stems, of a rich purplish brown, and very smooth. The leaves are two or three inches long and rather more than half that breadth, oval, varying from ovate to elliptic and obovate, sharply and finely serrate, usually somewhat cordate at base, and abruptly acuminate, smooth on both surfaces or scattered with a few silken hairs, when just expanded, afterwards smooth, purple when young, paler beneath. Petioles one fourth or one fifth the length of the leaves. Stipules very slender, lanceolate, invested with silky hairs, purple or faint crimson, falling off with the investing scales of the buds. Outer scales roundish, concave; inner, lanceolate, silky; all, crimson or purple, smooth without, silky-villose within. Flowers large, in spreading, often somewhat pendulous racemes, of from 4 to 8, on the ends of the branches, expanding in April or May, just as the leaves are beginning to open, with small, purple or faint crimson bracts at the base of the partial flower-stalks and often near the flowers. Segments of the calyx acuminate, edged and lined with silky down. Petals white, linear-lanceolate, narrowed at base, three times as long as the calyx. Fruit pear-shaped, purplish, very sweet and pleasant, ripening in June, earlier than any other fruit, and much sought for by birds.

The union of the crimson or purple of the scales and stipules, with the pure white of the flowers, and the glossy, silken, scat-

tered hairs of the opening leaves, gives a delicate beauty to this early welcome promise of the woods.

Dr. Darlington says that the fruit is considerably improved in size and quality by long culture.

A tree of this species standing near the comb manufactory in Chester, measured five feet seven inches in circumference, at five feet from the ground.

The second variety has been called the SWAMP PYRUS; SWAMP SUGAR PEAR; *A. ovalis*. The leaves are oval oblong, finely and sharply serrate, and finely acuminate, downy on both surfaces when young, very downy and white beneath; petioles, peduncles and calyx covered with a silken down; stipules slender, linear; segments of the calyx acute, ciliate; petals obovate, twice as long as the calyx, more persistent than in the last variety.

This is a smaller tree than the preceding, but sometimes rises to twelve or fifteen feet. It is usually, however, a shrub. It has a great resemblance to it, so that many botanists, and, among them, Dr. Torrey and Dr. Hooker, are disposed to consider it a variety of the same species. It cannot be easily determined what constitutes a specific difference, and what should be regarded as only an accidental variation. The points of distinction in this plant, however, are more numerous and more marked than are to be found between many nearly allied species in other genera. The leaves, when just opening, are completely invested, on the under surface, with a close, velvety, whitish down, while those of the *Botryopium* have only a few silken hairs; and a similar difference, not so marked, may be observed in the inflorescence. The leaves are less sharply serrated, the serratures being sometimes hardly visible. The racemes are longer, closer and more erect than in the foregoing, and the petals of the corolla more distinctly obovate. It usually occurs in low, moist grounds, and is one of the earliest and most conspicuous ornaments of swampy woods. The fruit is more juicy and agreeable than that of the former. Still there is not in the fruit a tithe of the difference which we observe between apples from the same orchard, and growing on trees which sprung from seeds of the same fruit.

Looked at as they are found in Massachusetts, these would, without hesitation, be regarded as two species. But when all the varieties, from the northern to the southern extremities of their native regions are examined, and found to run into each other by almost imperceptible gradations, they are very justly considered as only forms of one species. It is after such an examination that Drs. Torrey and Gray have arranged all the varieties under the one species *A. Canadensis*.—*Flora of N. A.*, I, 473.

Dr. Hooker says (*Fl. Bor. Am.* I, 203) that *Amelanchier ovalis*, according to Dr. Richardson, abounds in the sandy plains of the Saskatchewan, where its wood is prized by the Cree Indians for making pipe-stems and arrows; and it is thence termed by the Canadian voyageurs, *bois de flèche*. Its berries, which are about the size of a pea, are the finest fruit in the country; and are used by the Cree Indians, both in a fresh and in a dried state. They “make excellent puddings, very little inferior to plum-pudding.”

This plant, as described by the different botanists, affords a striking instance of the effect produced by climate. It is spoken of by Dr. Richardson, in the cold regions where he found it growing, as quite a tree. In England, where it has been cultivated, it is a small tree. In Massachusetts, one variety is a low tree, the other a shrub. Dr. Darlington describes it, in Pennsylvania, as having a stem from two to four or five feet high; and Elliot speaks of it as occurring, very rarely, as a small shrub two to three feet high. It is a northern plant, and he probably noticed it on its very extreme southern limit.

It would be an interesting experiment, well worth trying, to ascertain how far this fruit might be improved by the same kind of cultivation which has been given to the apple. All of the apple family seem to be particularly susceptible of amelioration. And if, by a long course of improvement, this fruit should be made to differ from its original stock as much as the golden pippin differs from the sour crab-apple from which it is supposed to have been formed, there are few fruits now known superior to what it would become.

The QUINCE TREE, *Cydonia*, is always a low, crooked tree, with straggling, tortuous branches. The flowers are large and showy, so that it would be well worth cultivating for them only; and the rich golden or orange fruit, weighing down the branches in autumn, is still more beautiful. The dark leaves, too, showing, when moved by the wind, their whitish, downy under surface, contrast agreeably with most of the other plants among which it makes its appearance in the corner of a garden.

It springs readily from seed, but is most easily and commonly propagated by layers. It may, also, be grafted upon the thorn, and thus add its beauty to the useful hedge.

It is said by De Candolle to be native in rocky places and hedges in the south of Europe.—*Prod. II*, 638.

FAMILY XXVIII. THE ALMOND FAMILY. *AMYGDALÆÆ*.
LINDLEY.

Trees or shrubs, with simple, alternate leaves, white or pink flowers, a calyx of 5 parts, a corolla of 5 petals, a single style, and fruit a drupe, or what is usually called a stone fruit. They are distinguished from the Rose and Apple Family by the fruit being a drupe, by their bark yielding gum, and by the presence of hydrocyanic acid in the leaves and kernel. The family includes the Almond tree, the Peach tree, the Apricot tree, the Plum and the Cherry trees.

The plants belonging to this family, are, with only three or four exceptions, natives of cold or temperate climates of the northern hemisphere. They are distinguished, in their properties, from those of the two preceding families, with which they have many points of resemblance, and to which they are by some writers united, by the presence, in the kernel and leaves, of the deadly poison known by the name of prussic or hydrocyanic acid. This renders the kernels of the peach and cherry so dangerous when used as food, and gives to noyau and the

other intoxicating liquors which are flavored by them, their fatal effects; and this principle, in the leaves of some species of cherry, as in the goat-killing cherry of Nepaul, and the Carolina cherry of this country, and in the leaves of our common black cherry, when wilted, renders them poisonous to some quadrupeds. This principle, however, is diffused in so slight a proportion through the pulp of the fruit, that the cherry, the peach and nectarine, the plum and the apricot, are a very delicious, and, in moderate quantities, a perfectly wholesome food.

The prunes, which we import from France, are the dried fruit of some varieties of the plum, which contain a sufficient quantity of sugar to preserve the fruit from decay, and even to yield a considerable quantity of brandy by distillation. The leaves of the sloe and bird cherry of Europe have been used to adulterate the black teas of China and even to take their place. Oil is expressed from the kernel of the almond, and from that of some of the plums. The bark of plants of this family contains an astringent principle, which renders it capable of being used in tanning, in dyeing yellow, and as a tonic and febrifuge in medicine. All of them yield a gum not unlike gum tragacanth or gum arabic, which is highly nutritious. It is doubtful if it ever flows without injuring the tree; and, if the wound be not healed, the loss is at last fatal.

Plants of this family, native and introduced, are peculiarly liable to the attacks of insects. Canker-worms of one or of several species, (*Phalæna* and *Anisópteryx*, Harris, 332—4), often strip them of their leaves; the tent-caterpillars, (*Clisiocampa Americana*, ib. 266—9), pitch their tents among the branches, and carry on their dangerous depredations; the slug-worms, the offspring of a fly called *Selándria céra*si, (ib. 383—4), reduce the leaves to skeletons and thus destroy them; the cherry-weevils, (*Rhynchænus céra*si, ib. 68), penetrate their bark, cover their branches with warts, and cause them to decay; and borers, (*Bupréstis divaricata*, ib. 43, or the still more pernicious *Ægéria exitiosa*, p. 233), gnaw galleries in their trunks and devour the inner bark and sap-wood.

XXVIII. 1. THE PLUM TREE. *PRUNUS*. L.

This genus is distinguished by its drupe, which is ovate or oblong, fleshy, very smooth, covered with a glaucous or bluish powder; with the nut compressed, acute at both ends, smooth, and not porous or furrowed, except by a slight furrow along the margins. It contains low trees, with deciduous leaves which are folded together in the bud,—natives of North America, Europe and Asia, many of them thorny in a wild state. They have showy flowers in fascicles or sessile umbels, rarely solitary, in the axil of the last year's leaves; and most of them bear edible fruits. The most highly valued cultivated plum trees are originally from the East, where they have been known from time immemorial. In many countries of eastern Europe, domestic animals are fattened on their fruits; and an alcoholic liquor called *Raki* is obtained from them; as is *Zwetschen-Wasser*, in Germany; and they yield a white, crystallizable sugar. They thrive best on calcareous soils, but will grow in any soil tolerably free, and not over moist, especially with a sub-soil of clay.

Most or all the cultivated plums, damsons and gages, are varieties of the *Prunus doméstica*, L., the cultivated Plum Tree. It is characterized by having its branches without thorns, leaves lanceolate or oval, concave on the surface, usually acute; and flowers mostly solitary. It is found growing wild in elevated situations in southern Europe.—(*D C. Prod.* 533.) This species, as also *P. institia*, the Bullace Plum, are considered by some botanists as varieties of the Sloe Thorn, *P. spinosa*, which is usually a thorny shrub or small tree.

The wood of all the kinds of the plum is compact, close-grained, hard, and beautifully veined, and takes a fine polish. It is much valued and used by turners, cabinetmakers and musical instrument makers, on the continent of Europe, and, in England, the wood of the sloe is used for handles of tools, teeth of rakes, and other small articles, and for walking-sticks.

Sp. 1. THE BEACH PLUM. *P. maritima*. Wanganheim.

Several varieties of this plum are found on Plum Island, and other islands on the coast and on the beaches, and by the roadside on the Cape, and in arid, sandy places, to the distance of twenty miles or more from the sea. It is a low shrub, with straggling branches, two to four feet in height, growing usually in bunches among the loose stones or in the sand. The stem is of a very dark purple, almost black, erect or prostrate, with oblong, horizontal, light ashen dots. The shoots are stout, brown, downy, dotted with orange. The leaves are rather closely set, on short, downy footstalks, elliptical or oblong, or oval, acute at each extremity, serrate, rather stiff, smooth above, downy, especially on the mid-rib and veins beneath, with usually 1 or 2 glands near the base or on the footstalk. The flowers appear just before the leaves, along the sides, near the ends of the branches, from the axils of last year's leaves, in numerous umbels of 2 to 6 flowers. Footstalk slender, half an inch long, smooth or with minute pubescence. Segments of the calyx green, obtuse, slightly downy. Petals inversely egg-shaped, white. Fruit from half an inch to an inch in diameter, globular, varying from crimson to purple in different varieties. It ripens in August and September. Flowers in May and June. This is an agreeable fruit, and is preserved in considerable quantities by the inhabitants of Plymouth and other maritime towns, as a sweetmeat.

Sp. 2. THE YELLOW PLUM. CANADA PLUM. *P. Americana*.
Marshall.

I have not found this species growing wild in Massachusetts, although, as it occurs on the north and south of us, it will probably be found here. It is often cultivated for its fruit, in the northern parts of New England, and makes a beautiful appearance in August, when the fruit is ripe and has a rich red or yellow color.

It is a small, round-headed tree, eight to fifteen feet high, with crowded, crooked, irregular branches, the older ones rough and

somewhat thorny. The trunk is covered with a very dark reddish or bronze green bark, resembling that of the cherry tree; the smaller branches of a reddish bronze color. The footstalks of the leaves are short, reddish, with often two glands on the raised border near the expansion of the leaf. The leaves are broad ovate, oblong oval or pear-shaped, tapering suddenly to a long point, and edged with rounded, double serratures, with a minute, shining, callous point at the extremity of each; smooth but conspicuously impressed with furrows over the veins above; pale, and somewhat downy along the mid-rib and at the axils of the veins beneath. The flowers come out in April or May, in close, crowded bunches of 3 or 4 each, near the ends of last year's branches. The fruit is roundish ovoid, somewhat flattened, and with a furrow on one side, reddish orange, when ripe, with a yellowish pulp, and a thick, leathery skin. The stone is much flattened and bordered with a thin border on all sides; kernel flattened, very bitter. The fruit, which is often nearly an inch in diameter, is sometimes sweet and pleasant, but usually rather austere, and used chiefly for preserving in sugar; but much improved, both in size and flavor, according to Dr. Darlington, by cultivation. Few attempts of this kind have been made. If they have already been rewarded by striking improvement, what might we not expect from a well conducted series of experiments, such as those of Van Mons, continued for many years? No native fruit promises better in this respect, as it has a wider range than almost any other North American plant.

Introduced species.

WILD BULLACE TREE. *P. insititia*. L.

A bush or small tree, found on the banks of Charles River, in Cambridge, by road-sides at Cohasset, and in other places in the vicinity of Boston.

The shorter, lateral branches, often end in a thorn. The leaves are an inch or an inch and a half long, generally obovate, or ovate-lanceolate, acute, tapering at base, serrate, downy beneath. The flowers and leaves come from different buds, by

which circumstance it is distinguished from the Sloe, which also is naturalized in some parts of the country. The segments of the calyx are entire, and obtuse. Petals white, inversely egg-shaped. The stamens are numerous. Style single, longer than the stamens. The fruit is usually round and black, covered with a yellowish bloom.

This plant was first pointed out to me by my friend E. Tuckerman, and I have since repeatedly met with it.

XXVIII. 2. THE CHERRY. *CÉRASUS*. Jussieu.

The name *Cérusus*, derived from a town on the Black Sea, from whence this tree is supposed to have been introduced into Italy, designates a genus of about forty species, natives of all the temperate regions of the northern hemisphere. They are trees or shrubs, with smooth, serrated leaves, which are folded together when young, and white or reddish flowers, growing in bunches, like umbels, preceding the leaves, or in terminal racemes, accompanying or following the leaves. The fruit is a fleshy drupe, globose, or with a hollow at base, and containing a nearly globose, smooth nut. A few species, with numerous varieties, produce valuable fruits; nearly all are remarkable for the abundance of their early flowers, sometimes rendered double by cultivation. Ten species are found in this country north of Mexico, of which the following occur in Massachusetts.

SECTION FIRST.—*Flowers in umbels, pedicels 1-flowered, springing from the buds.*

This includes most of the cultivated cherries, and

Sp. 1. THE NORTHERN RED CHERRY. *C. Pennsylvánica*.
Torrey and Gray.

Figured in Michaux, North American Flora, Plate 98.

The northern Red Cherry is a small, slender tree, rising sometimes to the height of twenty or twenty-five feet, with a diameter of six to nine inches. I have met with it in many parts of the State, and it occurs abundantly on the plains in the central counties. On the top and steep sides of Wachusett, it

is very abundant. 'Trunk erect, covered' with the greenish, brown, polished, membranaceous bark, characteristic of the cherry, with ferruginous, swelling dots. New shoots and spray very slender, with bark of a lighter, reddish brown. Leaves numerous, alternate or in pairs, rarely threes, at the end of the branchlets, on short, small petioles, which are channelled above; narrow, lanceolate or ovate-lanceolate, with fine, rounded, glandular serratures, acuminate, almost folded together, and nodding at the end, of nearly the same light green above and beneath; texture, thin and delicate; secondary nerves numerous, parallel; veins finely reticulate. Flowers rather large, in nearly sessile umbels. Segments of the calyx thin, rounded at the end, turned back. Petals white, broad, inversely egg-shaped. Fruit reddish, in very short corymbs of from 2 to 5, taking the place of the leaves at the end of last year's shoots, or in the axils of leaves on peduncles one inch long; with little flesh, very sour, and with a large stone. The fruit is not abundant, but occasionally a few branches are found completely loaded with it.

The wood is hard, close-grained, and of a reddish color, much resembling that of the common wild cherry; but as the trees are not often more than five or six inches in diameter, I know not that it would be of any considerable use. As it grows in the most exposed situations, it might probably grow readily, if sown or planted. In some parts of Maine and New Hampshire, this tree springs up abundantly on soil which has been recently laid open to the sun in clearing, and especially after it has been burnt over. There is a common opinion among the ignorant, that it springs up, without seed, in consequence of some action of heat upon the soil. If they would take the pains to examine, they would, however, find great quantities of the nuts or *stones*, as they are called, just beneath the surface of the ground. In climbing the wild hills of those States, I have repeatedly observed, in the beds of the streams, often the most practicable paths, surprising numbers of the nuts of this cherry, though there were no trees of the kind within a great distance.

This tree is found, according to Hooker, throughout Canada,

as far as the Saskatchewan, and from Newfoundland to the Rocky Mountains. It is found in all the New England States, but is not known beyond Pennsylvania.

Sp. 2. THE SAND CHERRY. *C. pùmila*. Michaux.

This has been found on Blue Hills, in Milton, by B. D. Greene, and rarely elsewhere in the State. It usually trails along the ground, raising its branches from three or four, to twenty inches high. The branches are brownish, with transparent, grayish, outer bark. The leaf-buds are small and purple; the leaves are usually inversely egg-shaped or lance-shaped, often nearly entire or serrate with a few indistinct teeth above, acute or rounded at the extremity, tapering to a slender footstalk, with linear, glandular-serrate stipules at base when young; pale green above, whitish beneath. The flowers, 2 or 3 together, are on slender stems, half an inch long. Segments of the calyx rounded. Petals white, rather small, inversely egg-shaped. Stamens numerous. Fruit small, dark red, eatable.

SECTION SECOND.—*Flowers in racemes, terminating leafy branches.*

Sp. 3. THE BLACK CHERRY. *C. serótina*. De Candolle.

A tree of middling size, with spreading branches, found in dry woods and often left growing along the roads. The bark on the recent shoots is green or olive-brown, polished, and dotted with minute, orange dots. It afterwards becomes darker, and on the small trunks and larger branches, is of the reddish or purplish brown, scattered with oblong, horizontal dots, characteristic of the cherry. Old trunks have a scaly bark, not unlike that of some of the pines. The leaves are ovate or lanceolate, oblong or obovate, rounded or acute at base, gradually tapering to a point, serrate with incurved serratures, polished above, lighter and smooth beneath, with sometimes a silken pubescence along the lower part of the mid-rib. Footstalk half an inch long, with usually 2 to 5 tooth-like glands near the base of the leaf. In autumn, the leaves turn to a deep orange, sprinkled

and bordered with scarlet and crimson. Later, they change to a pale, ochre yellow.

The flowers are small, pretty closely set by short stems, on a simple raceme, forming the end of a footstalk, four to six inches long, with 2 to 5 leaves at its base. It is erect or curved upward in flowering, which begins at the bottom; afterwards bends down with the weight of the fruit.

The wild cherry tree rarely rises, in Massachusetts, above the height of forty or fifty feet. It is found, according to Dr. Richardson, as far north as the Great Slave Lake in latitude 62° , where it attains the height of only five feet. On the sandy plains of the Saskatchewan, it rises to twenty feet. In Maine, it increases to thirty or more, and is seldom a foot in diameter. In western New York it rises to a great height and large size; but it reaches its perfection on the Ohio River, where Michaux found it sometimes from twelve to even sixteen feet in circumference, and from eighty to one hundred feet high, with a trunk of uniform size and undivided to the height of twenty-five or thirty feet.

The wood is of a light red or fresh mahogany color, growing darker and richer with age. The medullary rays, or what are commonly called the silver grain, are very numerous, and more closely arranged than in almost any other kind of wood; and when cut by a plane, not quite parallel to them, exhibit a beautiful appearance. It is very close-grained, compact, takes a good polish, and when perfectly seasoned, is not liable to shrink or warp. It is, therefore, particularly suitable and much employed for tables, chests of drawers, and other cabinet work, and when polished and varnished, is not less beautiful for such articles than inferior kinds of mahogany. It is particularly valuable for window sashes, as it retains a permanently smooth surface and is little affected by the weather. In some places it is used to make the posts of stair-rails and for doors, in which it looks extremely well. Gun-stocks and other small articles are also made of it. The most beautiful portion, commonly used, is that portion of the trunk where the branches begin. This part is often equal to the better kinds of mahogany. It would be worth the experiment, to manufacture that part of the

trunk which is beneath the surface of the ground. It might be found as beautiful as the roots of the black and yellow birch. The cabinet-makers of France increase the beauty of an inferior wood of this genus, (the Mahaleb cherry tree,) by sawing out the boards obliquely across the trunk, instead of parallel to its length. This brings out the silver grain to advantage.

Little other use is made of the fruit than to communicate their peculiar and very agreeable flavor, by maceration, to rum or brandy, making, what is variously called cherry brandy, cherry rum, cherry bounce, or simply cherry. Many other uses might, doubtless, be made of them. The flavor is decidedly superior to that of the cherry, from varieties of which the Kirchwasser and Maraschino of Alsace and Dalmatia are made. I would certainly say nothing to encourage the increased manufacture of intoxicating liquors. But, if they are to be made, it would be better that some fruit, now useless, should be employed for that purpose, than that the *staff of life* should be, as it now is, converted into its bane.

The bark is of a pleasant, aromatic bitter; leaving, when chewed, an agreeable taste in the mouth. An infusion of it, in boiling water, is sometimes drunk, in place of tea, for its tonic and presumed purifying effects.

The fruit is a favorite food of many birds, and if the tree were planted along the borders of orchards and woods, would serve as a protection to other fruit. This is, also, more than almost any other fruit tree, subject to the ravages of caterpillars; it might thus be a further protection to cultivated trees by inviting the butterfly from them to itself.

The wild black cherry* prefers a dry soil, but grows in every soil and in almost any situation. It may be raised from seed, in which case the fruit should be sown with the pulp as soon as it is ripe. It is, however, then subject to be destroyed by various animals. It may be kept in sand till spring, care being taken that it do not sprout. It may, then, be sown thin, and covered with a quarter of an inch of soil. Or it may be propagated by means of the sprouts which spring from about the trunk, near the root, taken off with a few radicles attached.

* *C. sylvestris*, the wild, Black-fruited Cherry of Europe.

Sp. 4. THE CHOKE CHERRY. *C. Virginiana*. Torrey and Gray.

A shrub or small tree, often only one or two feet high, and sometimes rising to twelve or fifteen. The trunk is dark colored, resembling an alder more than a common cherry tree; it rarely attains a diameter of two or three inches, and throws out a large number of branches, which in May are covered with flowers, and in July and August are usually bent down with a profusion of fruit. The shoots and young branches are of an ashen gray or olive green, growing darker after the first year. The leaves are broad-obovate, oblong or elliptic, rounded or sometimes heart-shaped at base, abruptly acuminate, sharply and finely serrate, smooth, green, and polished above, much lighter beneath, one to four or five inches long, and of two thirds that width. The footstalk is one half or three fourths of an inch long, round, channelled above, with always 2, sometimes 4 or more glands a little below the base of the leaf, or at equal distances further down. Fruit-stalks three to six inches long, green, with 2 or 3 small leaves near the base. Fruit on short stems, three or four lines in diameter, dark red, pleasant to the taste, but astringent. It differs very much on different plants; being sometimes very austere, sometimes very juicy and pleasant, with little astringency.

FAMILY XXIX. THE BEAN FAMILY. *LEGUMINOSÆ*.

JUSSIEU.

The peculiar distinction of this family is, that its flowers are butterfly-shaped, or its fruits in pods, and it often possesses both these characters. By one or the other all the plants of the family are known; and the butterfly-shaped flowers are a character not to be mistaken, as they are found in no other family. It includes herbs, shrubs and trees. The leaves, which are usually compound, rarely simple, have commonly two stipules at the base, and the branches have often projecting ribs, or

membranous wings. It is an immense and perfectly natural family, distributed throughout almost every part of the globe. De Candolle describes, as belonging to it, 280 genera, containing upwards of 2600 species. Of these, 900 species are found within the tropics, nearly 1300 north of them and 400 south. There are, at present, in all, not less than 3700 species.

*The distinctive characters of the Family are:—*Sepals united into a 5-cleft or 5-toothed calyx; the odd segment lowest. Petals 5, or, by abortion, fewer or none, either papilionaceous or regular, the odd petal superior. Stamens inserted, with the petals, into the base of the calyx, distinct or in one, two, or, very rarely, three bundles. Ovary simple, solitary, very rarely 2 or more, free from the calyx. Ovules solitary or several. Style proceeding from the upper suture. Fruit a legume, or sometimes a drupe. Seeds solitary or several, attached to the upper suture. Embryo straight or with its radicle bent back along the edge of the cotyledons. Cotyledons either remaining underground in germination, or rising above and becoming green like the leaves.

Of this family, Lindley says, “it is not only among the most extensive that are known, but also one of the most important to man, with reference to the objects either of ornament, of utility, or of nutriment, which it comprehends. When we reflect that the *Cercis*, which renders the gardens of Turkey resplendent with its myriads of purple flowers; the *Acacia*, not less valued for its airy foliage and elegant blossoms than for its hard and durable wood; the *Braziletto*, *Logwood*, and *Rosewoods* of commerce; the *Laburnum*; the classical *Cytisus*; the *Furze* and the *Broom*, both the pride of the otherwise dreary heaths of Europe; the *Bean*, the *Pea*, the *Vetch*, the *Clover*, the *Trefoil*, the *Lucerne*, all staple articles of culture by the farmer, are so many species of *Leguminosæ*; and that the gums *Arabic* and *Senegal*, *Kino*, and various precious medicinal drugs, not to mention *Indigo*, the most useful of all dyes, are products of other species,—it will be perceived that it would be difficult to point out an order with greater claims upon the attention.”

The general character of the family is, to be eminently whole-

some; but to this there are some striking exceptions. The seeds, roots and leaves of some species are poisonous. Many, as the Cassia, Senna, and others, have cathartic properties. Some of them are powerful tonics, and others, from possessing an analogous principle, are of use in tanning. A few have narcotic properties, and some contain a principle which is poisonous. Gum lac, gum Arabic, gum animé, gum tragacanth, and manna, are derived from plants belonging to this family. Many of the woods are valuable as furnishing dyes. Such are Brazil wood, Logwood and Sandal wood. The most valuable of the balsams, the Balsam of Copaiva, Balsam of Peru, and of Tolu, flow from wounds in others; and the fragrant Tonka bean is the produce of a plant of the same comprehensive family.

De Candolle, in his *Prodromus*, divides this vast family into four sub-orders, and these into eleven tribes, which are still farther divided into sub-tribes. His first sub-order is

THE PAPILIONACEOUS, *Papilionaceæ*, L., comprehending plants having a calyx with distinct lobes; and a papilionaceous, or butterfly-shaped corolla. These are arranged in two divisions, the first comprehending plants whose cotyledons in germination rise above the surface and become green like leaves: the second, those whose fleshy cotyledons remain beneath the surface. To this latter division belong those valuable plants, which, under the name of pulse, furnish so much food to man.

Of the first the seeds are not eaten, but it includes many valuable trees.

TRIBE I. *LOTÆÆ*.

SUB-TRIBE IV. *Galegeæ*. D C. II, 243.

Legume 1-celled. Stamens in two bundles, more rarely in one. Herbs, Shrubs and Trees. (*Galegeæ*, Torrey, Tribe III, *Flora of N. A.*, p. 292, which also includes two genera of the sub-tribe *Clitòreæ*).

THE LOCUST TREE. *ROBINIA*. L.

A North American genus of a few species of trees or shrubs, often bearing stipular spines, with leaves unequally pinnate, the leaflets on short stems with little stipules at base. The flowers are white, rose, or flesh-colored, in showy, axillary racemes, usually pendent. The calyx has 5, lanceolate teeth, the

two upper shorter and cohering or approximate. The banner of the corolla is ample, the keel obtuse. The stamens in 2 bundles, deciduous. The style is bearded next the free stamen. The fruit is a many-seeded pod, with the seed-bearing edge margined, and with thin and flat valves.

The locust trees, particularly the Common, are subject to the assaults of many insects. The leaves of the common locust serve as food and habitation to the caterpillars of the Tityrus skipper, a large, brown butterfly with honey-yellow spots, (*Harris's Report*, p. 224, where is found an interesting account of the habits of the caterpillar). The bark is punctured and the sap sucked by the two-spotted tree-hopper, (*Membracis bimaculata*, ib. p. 179). The pea-weevils, (*Bruchus pisi*, ib. p. 55), lay their eggs in the seeds as they do in those of the pea and other leguminous plants; and the grubs of an *Apion* beetle, (ib. p. 59,) inhabit the pods and eat up the seeds. The grubs of the painted *Clytus* beetle, (ib. pp. 86 and 295,) burrow in the bark and devour the soft inner portion, in autumn, and in spring they bore through the sap-wood, more or less deeply into the trunk, which they traverse by many winding and irregular, upward passages. A small reddish caterpillar (supposed by Dr. Harris to belong to one of the *Ægerian* sphinges, or to one of the *Bombyces*, see p. 295 of his Report), lives in the pith of the small branches and trunks of very small trees. The irritation causes the twig to swell and become spongy in the parts affected, and easily to break off at these places. The large caterpillar of the locust tree carpenter-moth, (*Xyleutes Robinia*, ib. pp. 296—7), bores the tree in various directions, appearing to prefer old and full grown trees. For full accounts of these several enemies of the locust tree, which threaten, if not checked, to exterminate the tree, I must refer to the admirable Report of Dr. Harris.

Two species of locust, besides the Common, are natives of the southern parts of the country and may be cultivated here: *R. viscòsa*, the Clammy-barked locust, which is a small tree, with large, showy, pale pink flowers; and *R. hispida*, the Rose Acacia, a very beautiful flowering shrub.

THE COMMON LOCUST TREE. *R. pseudacacia*. L.

Figured in Audubon's Birds, II, Plate 104. Figured by Michaux, Plate 76.

Three varieties of the tree figured in Loudon's Arboretum, V, 71.

The locust, in Massachusetts, is never of a first rate size or height, but is often a graceful and always an extremely picturesque tree. The trunk rises sometimes directly upwards to a considerable height without branches, sometimes inclined to one side, and very irregular and bare, sometimes, on the edge of a wood, feathering down to the ground on one side. The bark is thick, and, on old trees, very deeply and irregularly furrowed with long furrows, and of an ashen or granite color. On the branches it is ash gray, and on the slender, wand-like spray, purple or purplish green. The soft and velvety foliage is too smooth to retain the dust, and is often seen, bright and clean, on the side of a dusty road. While the heart of the tree is so liable to the attack of insects, that several trees are not often seen together which do not present a dead or dying limb, the leaves seem peculiarly exempt, and often show like an image of the freshness and vigor of youth, in contrast with the melancholy one of premature decay.

Flowers very fragrant and beautiful, in long pendulous racemes from the axil of the upper leaves. The partial flower-stalks half an inch long. Calyx an irregular, purplish tube, ending in 2 obtuse and 3 acute segments. Corolla white, butterfly-shaped. The lower petal nearly round, notched at the end and reflected, yellow in the middle. Side petals oblong, irregular, on a long claw, meeting below the keel, which is formed of 2 petals grown together and embracing the stamens; these united, form a tube, in the middle of which is the curved style, with its capitate stigma.

The leaves are compound, the leaf-stalk channelled above, and angled beneath. The leaflets are from 9 to 25, on short petioles, oblong, elliptic or egg-shaped, rounded at the extremity, with a short point, smooth or silken-downy, light green above, lighter beneath. At the foot of each is a single, minute, linear stipule, about as long as the partial footstalk. Each leaf is folded on itself before opening, and the half-expanded leaflets

are straight and parallel like the teeth of a comb. The prickles are at the base of the leaves, short, somewhat triangular, dilated at base, sharp, dark purple, adhering only to the bark, but persistent.

The root is not large, but throws out numerous fibres which creep extensively in every direction, just below the surface, the smaller ones often forming little tubercles. Searching thus for nutriment where it is most abundantly to be found, the tree is of remarkably rapid growth while young. In ten years, it will reach the height of twenty or thirty feet. After that, however, except in exceedingly rich soil, its growth is comparatively slow. It would be natural to suppose that a tree, whose roots run so near the surface, should be exhausting to the soil, and so it is often considered. I am assured, however, by many gentlemen, that few trees are less injurious to the grass of pastures, and several persons have recommended that it should be planted on the borders of pasture land in preference to any other tree. The leaves are sweet and nutritious to cattle, and the droppings of the tree and its flowers are thought to have a favorable effect on the growth of grass.

The locust is not known to be, nor is it generally considered, a native of the State or of New England; and it is doubtful whether it grew naturally in the northern part of the Middle States. Michaux says it first occurs growing naturally between Lancaster and Harrisburg, in Pennsylvania, in the latitude of $40^{\circ} 20'$, but that, west of the mountains, it is found two or three degrees further north; and that it abounds most in the valleys amongst the chains of the Alleghany Mountains. It does not grow spontaneously near the sea-coast, even in the Southern States. It is common in all the Western States, and attains its perfection in Kentucky and Tennessee, where, in a fertile soil, it sometimes exceeds four feet in diameter and a height of seventy or eighty feet.

The wood of the locust is of a remarkably compact, close and fine grain, the medullary rays or plates of silver grain being closer and more numerous than in almost any other tree. It varies in color in different varieties. In that which commonly grows in Massachusetts, it is of a yellowish white or straw color.

In some, it is of a greenish yellow, in others, of a reddish color. This last is considered far the most valuable timber. In the Western States, it is said there is a black variety. These varieties are probably dependent on the qualities of the soil. All, however, have the properties of strength and durability in a remarkable degree. And in these respects and in stiffness, hardness, elasticity and weight, the best locust is superior to any northern oak. According to Barton, its strength, as compared with English oak, is as 1867 to 1672. The weight was found, at Brest, in 1823, to be one sixth greater than that of oak. Experiments made at the Royal Naval College at Woolwich, show its lateral strength in resisting fracture, to be to that of oak as 100 to 75.

As long ago as 1601 or 1635, for accounts differ, the locust tree was introduced into France from America by Jean Robin or his son Vespasian, in honor of one or the other of whom, it received from Linnæus the name of *Robinia*. Since that time, it has been much cultivated in that country and in England, for the beauty of its foliage and the fragrance of its flowers. In 1823, the celebrated Cobbett, after spending some time in America, went back to England, and produced a great sensation by his writings in commendation of this tree. For some of the purposes for which he recommended it, it has been found of little value. For others, its importance is acknowledged. Where resistance to a strain is required, it is considered superior to any other wood. And the durability of the heart-wood, when employed as posts or in fences, or in other situations exposed to the weather, is ascertained to be extraordinary.

In this country, the value of the timber is almost universally known and acknowledged. In ship building it is employed for floors and floor timber, in preference to any other timber. For treenails it is preferred to every other wood, and great quantities of it are annually exported for that purpose. In the Middle States, where it grows more freely and abundantly than here, it is valued for all uses in which strength is required, and durability in places in exposure to the weather. For posts of gates, therefore, and for sleepers, it has been found invaluable. The same has been found true in this State, and, for all such

purposes, as much of it is consumed as can be obtained. The aborigines of the south used the wood for bows, on account of its toughness and elasticity. It is used for mill-cogs and for other articles exposed to constant wear.

The leaves are used, in some parts of Europe, either fresh or cured, as nourishment for horses; the seeds are found very nutritious to fowls. The leaves may be made a substitute for indigo in dyeing blue, and the flowers are used by the Chinese for dyeing yellow.

The practice of planting this tree by road-sides and along the enclosures of pasture lands has much increased, of late years, but has been checked by the fact that, in such situations, it is exposed to the inroads of an insect, whose worm penetrates to the heart of the tree and destroys its life. An unexpected remedy has, however, been suggested by the success of Joseph Cogswell, Esq., in the cultivation, some years ago, of a large plantation of the locust. He found that when it forms a wood, those trees only are attacked by the worm which form the outskirts, exposed to the sun and free air. Whether it is that the insect parent of the worm delights, as many do, in the sun light, and avoids the shade of the woods, or from whatever cause, it was found that all the interior of the plantation was free from its attacks. If this conclusion should be confirmed by further experience, it will be best, whenever the tree is cultivated for its timber, to plant it in masses of several acres in extent, and to substitute, in the sunny and exposed situations which it has usually held, some of those numerous trees which flourish best in them.

No tree promises better, as a cultivated forest tree, than this. Its very rapid growth, its numerous and valuable properties as timber, and the fact, that the sap-wood is converted into heart-wood earlier than in almost any other tree, are very strong recommendations. It is the experience of many persons in different parts of the State, that the locust grows on poor land better and more rapidly than any species of hard wood. On such land, however, large, sound timber of locust cannot be produced, and it would always be good economy to fell it within thirty or forty years, or, at least, not to allow it to grow, for timber, to a

great age. The various kinds of pine are better adapted to the poorest soils. But in rich, sandy loam, locust trees of a moderate timber size may, probably, be produced with greater ease and in a shorter time than any trees possessing the same valuable properties.*

As an ornamental tree, it must continue to be cultivated. It is true that it is liable to be broken by the wind, and that it never is full enough of branches to cast a deep shade. But the beauty of its foliage is almost unrivalled, and such pendent racemes of fragrant flowers are found on no other tree.

The locust may readily be propagated by the suckers which spring up in great numbers, to some distance, around the tree. But the readiest way is by seed. This, which is ripe in October, may be sown immediately, and will come up the following summer. Cobbett recommended that the seeds should be previously steeped in hot water. He was, however, speaking of seeds which had been sent from this country to England; but he professed to have received the suggestion from those acquainted with the cultivation on Long Island, where it has been planted more extensively than in any other part of this country. If the seed is to be kept over the winter, it should be preserved in the pod, in which it retains its vegetative power much longer than when separated.

It should be sown in a rich, loamy soil, and covered lightly to the depth of one fourth or one half of an inch. The plants will often grow from two to three or four feet high in a single season, and may be immediately transplanted, and with less of root than almost any other tree.—(*Loudon, Arb.* 624). The most agreeable effect is produced by trees standing alone or in groups of a few together. If planted for the timber, it should be, as has already been said, in plantations of several acres.

In the same family is found the *Gleditsia*, a native of the south, one species of which, *G. triacanthus*, the Sweet Locust or Honey Locust, is sometimes found in this State, growing

* William Buckminster, Esq., states, in the *N. E. Farmer*, of July 16, 1830, that a sprout from a young stump of Yellow Locust grew sixteen and a half feet in one summer; and that it is not uncommon, on good land, to witness a growth of eight and ten feet.

well in a rich soil in sheltered situations; remarkable for its triple thorns, its doubly pinnate leaves, and its pods of twelve or fifteen inches in length.

Two other trees of this family, the Kentucky Coffee Tree, *Gymnocladus Canadensis*, and the Canada Judas Tree, *Cercis Canadensis*, grow naturally as far north as this, though I know not that they have been found native in Massachusetts. Both are occasionally cultivated here as ornamental trees. The former is not remarkable for its beauty, though striking by its singular appearance. The latter, often called the Red Bud, is curious from being covered with bunches of flowers of a rose color, before the leaves begin to appear. They give a brilliant appearance to the whole tree except the extremities of the branches. The leaves, which begin to come out while the flowers are expanded, are folded together, before opening, on the mid-rib; they are broad, heart-shaped and pointed, and very smooth above and beneath.

The Red Bud is a fine showy tree, early in the season, and not without beauty at all times.

CHAPTER VI.

PLANTS WITH MANY PETALS, WHICH GROW, TOGETHER WITH THE STAMENS, ABOUT OR UPON A DISK SURROUNDING THE SEED-VESSEL.

FAMILY XXX. THE VINE FAMILY. *VITACEÆ*. JUSSIEU.

THE Vines are trailing or climbing shrubs, with swollen, separable joints, and alternate leaves with stipules. On the side of the stem opposite the leaves, spring the footstalks which bear the clusters of flowers. When the flowers are abortive, the footstalk is changed into a tendril; and tendrils opposite the leaves are peculiar to this family. The flowers are small, greenish, and commonly perfect; calyx minute, nearly entire, 5-toothed; petals 5, distinct, caducous; stamens as many as the petals and opposite them, inserted on the surface of the disk; ovary 2-celled, with 2 erect ovules side by side in each cell; style short or wanting; stigma simple. Fruit a round, pulpy berry, with 1 or more cells and 1 or more seeds. Seeds erect, with a bony shell. Embryo straight, short; cotyledons flat, lanceolate; radicle inferior.—(*Flore Française*, V, 857.) Plants of this family have acid properties and yield sugar. They are found in the woods of the milder and hotter parts of both hemispheres. There are two genera in this State: 1, the Grape Vine, *Vitis*, with entire leaves; and 2, the Virginian Creeper, *Ampelopsis*, with leaves divided into five parts.

XXX. 1. THE GRAPE VINE. *VITIS*. L.

This is a small genus, thus characterized: Calyx nearly entire; petals 5, commonly united at the apex, but distinct at base and falling off like a cap; stamens 5; style short, conical, stigma dilated. Peduncles sometimes changed into tendrils. Flowers, in the North American species, perfect or containing only stamens, or only pistils, on the same or different plants.

The wine-producing grape vines of Europe are varieties of one species, a native of the temperate parts of Asia, but introduced, at a very remote period, into Greece, and afterwards into Italy and thence into Central and Western Europe. In its wild state it produces berries not larger than currants. The numerous valuable varieties have been produced by long continued culture in favorable climates and soils. It flourishes best between the parallels of 30° and 45° of north latitude; but is cultivated successfully as far north as 47° , in the west of France; as far as 48° or 49° , in Hungary and on the Don; and on the Rhine as far as 50° . The trunk sometimes attains a great size; in rare instances, even three feet in diameter. The wood is hard, close-grained, smooth, and susceptible of a fine polish. The fruit is wholesome and nutritious, and forms an important article of food in several countries of Europe.

Most of the species of vine native with us produce no valuable fruit. Possibly use might be made of their leaves. Sir James Hall, a distinguished experimental philosopher, father of Capt. Hall, the traveller, ascertained that the leaves of the grape vine, dried in the shade, made an excellent substitute for tea. Treated like malt, they produce a liquor of a vinous quality, which forms a substitute for beer, and which may be converted into a valuable vinegar.

Four, perhaps five, species of grape vine are found in Massachusetts.

Sp. 1. THE FOX GRAPE. COMMON GRAPE. *V. labrusca*. L.

This is the common wild grape of Massachusetts, and is found in every part, in rich low grounds, overspreading clumps of bushes, climbing to the tops of trees, and embowering them with its thick and abundant foliage, or covering walls and rocks. It is easily distinguished from the other vines by the tawny down which covers the branches, leaf- and flower-stalks and tendrils. The recent shoots are of a light green, downy, and sometimes dotted with brown dots. Leaf-stalks large, round. Mature leaves heart-shaped, 5-angled, orbicular, sometimes 3- or 5-lobed, sinuses rounded or obtuse, lobes often acuminate; very obtusely dentate, with the teeth mucronate;

smooth or slightly pubescent above; abundantly white, downy or woolly, and ferruginous along the veins, beneath; down often tawny; principal veins 5, and, with the secondary veins and veinlets, prominent; young leaves with a rusty down, particularly on the nerves and veins, on both surfaces. Tendrils slender, once or twice divided. The racemes of flowers are short, with usually one short branch, the flowers crowded in umbels.

The fruit of this vine varies much in size, color, and time of maturity, as well as in taste. The berries are from one half to three quarters of an inch in diameter.

One of the most remarkable varieties is the Summer White Grape or Early White. In appearance, it presents some peculiarities. The leaves are on rather long, bristly and downy foot-stalks, with a rusty down closely covering the under surface. The fruit is two thirds or three quarters of an inch in diameter, round, pale green, or of the translucent color of the Malaga grape, when just ripe, afterwards turning red. It is, in some varieties, very agreeable to the taste. It ripens in the last of July and in August and September. I have gathered some of this variety in the woods, decidedly superior to the Isabella grape.

Another very common variety is the Early or Summer Fox Grape. Of this the fruit is about seven eighths of an inch in diameter, of a very deep glossy purple, almost black, with a bluish bloom, pleasant to the taste, ripe in the end of August or in September.

A more common variety is the late Fox Grape. This has a dark purple, almost black, berry, quite large, sometimes nearly an inch in diameter, but of an austere, disagreeable taste.

There are many other varieties. From the seeds of grapes of this kind have been produced the Isabella, the Catawba, Bland's Grape, the Schuylkill, the Elsinburgh, and others. It promises much from the effects of cultivation.

Sp. 2. THE SUMMER GRAPE. *V. æstivâlis*. Michaux.

Figured in Audubon's Birds, with the Pileated Woodpecker, II, Plates 111 and 114.

This vine has much the habit of the last, but may be commonly distinguished by the absence of down upon the branches and leaf-stalks, and by the nakedness of the lower part of the very long trunk, in consequence of the dying of the lower branches.

The recent shoots are smooth, or with very little down, hardly dotted. The leaves are four to seven inches long, and somewhat less in width, very deeply heart-shaped, more inclined to 3- than 5-angled, often deeply lobed; when young, they are of a reddish or purplish tinge, shining above, with tufts or cob-webs of brown down beneath; when old they are glaucous beneath, and downy only on the nerves and veins,—which are often purple near the radiating point.

Tendrils long, smooth, once or twice divided. Racemes very long, compound, the lower branch often becoming a tendril. Berries half an inch in diameter, dark blue, of an agreeable taste,—ripe in October.

Of this grape there are several varieties, one of which is so marked that Pursh suspected it of being a separate species. It is conspicuous for its very deep, palmate lobes, separated by rhomboidal sinuses. I have not been able to examine the fruit and flowers. It is the Frost Grape or Winter Grape, *V. sinuata* of Pursh, a vine with 5-lobed leaves, the lobes arranged almost in a circle, the lower ones meeting or nearly meeting at base. Sinuses of the shape of the hull of a ship, nearly closed in by the lobes, and rounded or acute at base. Surface nearly smooth above, whitish or glaucous, with little tufts of ferruginous down thickly scattered, together with hairs, on the nerves and veins beneath; margin serrate with large obtuse serratures. Fruit in clusters long and simple, or with 2 to 5 branches, small, half an inch in diameter, ripened by the first hard frosts, thence called Frost Grape, but always acerb. Fruit-stalk smooth, purplish, fruit purple. Trunk deep purple, bark separating in long slender stripes. This agrees in many respects with the

Summer Grape, but differs in the form of the leaves and particularly in the time of maturing the fruit and in its taste. I am therefore inclined to think Pursh's conjecture, that this is a distinct species, correct.

Sp. 3. THE WINE GRAPE. CHICKEN GRAPE. *V. cordifolia*.
Michaux.

This vine is a less vigorous climber than either of the preceding, and has a more delicate appearance. It delights to climb over rocks, along which it extends twenty or thirty feet. It is distinguished for its very short joints and the green color of both surfaces of its leaves. The recent shoots are purplish green, smooth or slightly hairy. Leaves on short petioles, which have a few short hairs; somewhat 3- or 5-lobed, heart-shaped at base, acuminate, with large, sharp, deeply cut teeth; ciliate on the margin, green on both surfaces, hairy on the nerves, and with cottony tufts at the angles beneath.

Fruit in short clusters, with 6 to 8, short, crowded branches, dark purple, almost black, when ripe, with a dark blue bloom, about the size of a large pea. Seeds about 2; no core; skin very thin; pulp deep purple, almost black. The fruit is very acid, but pleasant, with a rich, spicy taste, and without any acerbity remaining after eating it. It ripens late, and is not affected by the frost.

Of the juice of this grape, Mr. Andrew Mallory, of Russell, has made half a barrel of wine at a time. It is described as of excellent quality, having a strong resemblance to Port. The plant is a free bearer and seems to promise much as a wine producer.

Sp. 4. THE RIVER GRAPE. SWEET SCENTED GRAPE.
V. riparia. Michaux.

I have found this vine on the Westfield River and on some other tributaries of the Connecticut, and in Worcester County, but not in the eastern parts of the State; and I have found only the barren flowers. It has the same appearance as the preceding, differing in the greater pubescence on the stalks, veins, and margins of the leaves.

The flowers of all the wild grapes have a pleasant fragrance, not unlike that of mignonette: of this species the flowers are still more fragrant.

XXX. 2. THE CREEPER. *AMPELOPSIS*. Michaux.

A genus of a few species, which are found in Africa, in Java, but mostly in the United States. Calyx entire. Petals 5, distinct, spreading, reflected. Ovary conical, not immersed in the disk, 2-celled, with 2 ovules in each cell; style short. Berry 2-celled; the cells 1- or 2-seeded.

THE VIRGINIAN CREEPER. *A. quinquefolia*. Michaux.

Figured in Abbott's Insects of Georgia, I, Plate 30.

This is the most ornamental plant of its genus, and has been extensively cultivated in this country and in Europe. It recommends itself by its hardiness, the rapidity of its growth and the luxuriance and beauty of its foliage. In its native woods it climbs rocks and trees to a great height. In cultivation, it is often made to cover walls of houses forty or fifty feet high,—clinging by rootlets which proceed from its tendrils. Its recent shoots are green or purplish brown, with long orange dots. The older stalks are covered with a sort of net-work of cuticle, the meshes of a uniform size, except that they enlarge at the axils of the branches. Leaves on very long, channelled, purple or crimson leaf-stalks; of 5 leaflets palmately arranged. Leaflets irregular, obovate, wedge-shaped below, acuminate, with a few mucronate teeth above and sometimes a little below the middle, smooth, nearly of the same deep green on both surfaces, turning purple, deep red, or crimson, early in autumn. Tendrils opposite the leaves or branches. As in the vine, the stem seems to be formed by the successive development of axillary buds. Stem often strangulated or nearly cut off by a tendril. This plant continues to flower and attract the humble bee and the honey bee through July and August. The flowers are of a reddish green. The calyx is an even or slightly waved border, encircling the base. The petals, which are perhaps true sepals, are completely reflexed and slipper-shaped, reddish, with a yel-

lowish green border. Stamens 5, erect, opposite the petals, inserted at the base of the ovary, which is reddish and conical, surmounted by a roundish stigma without a style. Fruit in terminal or axillary panicles, or opposite the leaves. The stalks successively dividing by threes, at equal angles. The berries become dark blue or nearly black, when mature; at the same period, the fruit-stalks and tendrils assume a rich crimson or red color.

The great variety of rich colors,—shades of scarlet, crimson, and purple,—which the leaves and stems of this plant assume, and the situations in which we see it, climbing up the trunks and spreading along the branches of trees, covering walls and heaps of stones, forming natural festoons from tree to tree, or trained on the sides and along the piazzas of dwelling houses, make it one of the most conspicuous ornaments of the autumnal months. Often, in October, it may be seen mingling its scarlet and orange leaves, thirty or forty feet from the ground, with the green leaves of the still unchanged tree on which it has climbed.

FAMILY XXXI. THE BUCKTHORN FAMILY. *RHAMNACEÆ*.

JUSSIEU.

Found every where except in the polar regions, but chiefly in the hotter parts of the United States, Europe and Asia, and the northern parts of Africa.

The inner bark and fruit of the Buckthorns, as well as of most plants in this family, have active cathartic powers, and some of them are also emetic and astringent. The young shoots and leaves of one species, *R. alaternus*, dye wool of a yellow color. The bark and berries of another, *R. tinctorius*, are valued as dyes. The Avignon berry, the fruit of *R. infectorius*, is used to give its yellow color to Morocco leather. A similar dye is obtained from several other species, natives of the shores of the Mediterranean. With preparations of iron, some of them give a good black. The aromatic leaves of a species of Sage-rètia, *S. theæzans*, are used by the poor in China as a substitute

for tea. The lotus of the ancients, eating which,—as was fabled by Homer,—men forgot home and friends,—was the fruit of *Zizyphus lotus*, and gave a name to the nation that subsisted on it. The delicate jujube paste is prepared from the fruit of another species of the same plant, common in the markets of Constantinople. *Christ's Thorn*, a plant common in sterile places in Palestine, has its name from a tradition that it furnished the crown of thorns for the brow of the Saviour.

There are two genera in Massachusetts :

1. *Rhamnus*, with flowers in small, axillary bunches ; and
2. *Ceanothus*, with flowers in large, showy, terminal bunches.

XXXI. 1. THE BUCKTHORN. *RHAMNUS*. L.

This is a genus of thirty or more species of shrubs or small trees with alternate or rarely opposite leaves, on short petioles ; and minute flowers usually growing in short, axillary clusters. The calyx is 4- or 5-cleft, with its tube lined with a thin disk ; the petals 4 or 5, emarginate or 2-lobed ; ovary 2- to 4-celled, not immersed in the disk ; styles 2 to 4. The fruit is drupe-like, and contains 2 to 4 cartilaginous nuts.

Sp. 1. THE COMMON BUCKTHORN. *R. catharticus*. L.

The buckthorn is often found growing wild in the neighborhood of Boston, and rarely in other parts of Massachusetts, but it was probably introduced from Europe, where it is a native. It is an upright, branching bush or low tree, growing to the height of ten or fifteen feet, with a smooth stem of reddish brown or grayish olive, and grayish limbs. The lower branches are short and stiff, nearly horizontal, and end in a rigid, sharp point. They thus act as thorns, though leafy. The leaves are nearly opposite, broad-oval or ovate, irregularly toothed or notched or waving on the border, of a soft texture, smooth above, somewhat hairy on the prominent veins beneath.

The flowers have 3 or 4 stamens. The berries turn to a shining black in autumn. They are found in clusters, on short

stalks coming from the axil of the lower leaves, or beneath them. They are large and globose, and contain 4 prismatic, cartilaginous seeds or nuts.

The fruit of the buckthorn was formerly employed in medicine as a purgative, but is too violent and drastic to be safely used, and is now chiefly confined to veterinary practice, to which it is well adapted. The saffron-colored juice of the unripe berries, called *French berries* by dyers, is used as a paint and a dye. *Sap green* is made of the inspissated juice of the ripe berries, with alum and gum Arabic. If gathered very late they yield a purple instead of a green color. The bark furnishes a beautiful yellow dye; or, dried, it colors brown. The wood of the roots is yellowish-brown, with a satiny lustre, and very compact, and may be employed by the turner. Sheep and goats are fond of the leaves, but cattle refuse them.

The buckthorn is well suited to form hedges, either by itself or still better in conjunction with the thorn. It bears pruning, grows rapidly, is tough, and not liable to the attacks of insects, and is hardy, and not difficult as to soil. It puts forth its leaves early in the spring and retains them late in the fall; and its bunches of rich black berries are very showy in the autumn. It may be propagated by seed, which comes up the first season, or by suckers or layers.

The seed should be sown in the fall, when fresh from the tree. It vegetates early next spring. The plants may remain in the seed-bed a year, and then be transferred to the nursery until they are eighteen inches or two feet high, when they may be planted in a single or double row, eight or nine inches apart, for a hedge. As soon as they begin to vegetate, they should be headed down to within six inches of the ground. This causes them to thicken at the bottom;—an important point, whether utility or beauty is considered.

Sp. 2. THE ALDER-LEAVED BUCKTHORN. *R. alnifolius*. L'Heritier.

A stout, very leafy bush, three or four feet high, growing in clumps, in moist lands, with a dark colored stem and grayish branches. The leaves are broad-oval, two or three inches long,

acute or rounded at base, obtusely serrate, acuminate, smooth on both surfaces, with a slight down on the mid-rib and veins above, the veins very prominent beneath. The flowers are on short stems in the axils of the lower leaves of the recent shoots. The tube of the calyx is cup-shaped with the segments spreading. The fruit is black, fleshy, somewhat pear-shaped. Flowers in May and June.

XXXI. 2. THE JERSEY TEA. *CEANO-THUS*. L.

Shrubs, or somewhat shrubby plants, not thorny. Roots large, reddish, astringent. Leaves alternate, commonly ovate, or elliptical, serrate or entire. Flowers white, blue or yellowish, in umbel-like fascicles, which are aggregated at the extremity of the branches. Calyx bell-shaped, 5-cleft; the upper portion at length separating by a transverse line; the tube adhering to the base of the ovary. Petals 5, longer than the calyx, saccate and arched, on long claws. Stamens projecting. Disk fleshy at the margin, surrounding the ovary. Styles 3, sometimes 2, united to the middle, diverging above. Fruit dry and coriaceous, mostly 3-celled, obtusely triangular, girt below by the persistent tube of the calyx, 3-seeded, the cells at length opening. Seeds obovate.

THE NEW JERSEY TEA. *C. Americanus*. L.

A low, bushy shrub, one to three feet high, flowering in June and July, growing on dry, sunny slopes. The stem is of a polished olive green below, striated with brown. Recent shoots of a lively green, turning brown, on drying, smooth, or sometimes downy. The leaves are 2 to 2½ inches long, and 1 to 1½ wide, conspicuously 3-ribbed, on short footstalks, oblong-ovate, tapering gradually to a point, serrate, with the serratures ending in a brown, glandular point, smooth above, paler and somewhat downy beneath, the down on the footstalk and veins often rust-colored.

The minute white flowers are in crowded clusters, on the sides, short branches and end of long downy footstalks, which proceed from the axil of the upper leaves, and have one or

two small leaves on them. Each flower stands on a white, thread-like stalk. The calyx ends in 5 rounded segments, bent inwards. The petals are oblique, covered cups, on a thread-like claw, alternating with the segments of the calyx.

The fruit is a dry, 3-sided berry, with very obtuse angles, lying in the enlarged lower portion of the calyx, and opening from the centre. Seeds 3, inversely egg-shaped, shining and smooth, slightly flattened on one side.

The leaves have been used as a substitute for tea. The bark of the roots, which is of a deep red color, has astringent qualities, and has been successfully used, in infusion, tincture, or powder, to produce the effect of astringent medicines. In Canada, it is used to dye wool of a Nankin or cinnamon color.

FAMILY XXXII. THE STAFF-TREE FAMILY. *CELASTRA'CEÆ*. R. BROWN.

This is a small family, comprising low trees or shrubs, sometimes climbers, with alternate or opposite leaves, and flowers which are usually perfect, but sometimes sterile and fertile on different plants, arranged in racemes or cymes. They are natives of the warmer parts of both continents, chiefly without the tropics, abounding especially at the Cape of Good Hope. Several species of the Spindle Tree, *Eúonymus*, are valued in ornamental gardening, as are the Bladder-nut and Wax-work of our own woods. The properties of the family are not well known. The fruits and seeds of some species produce purgative and emetic effects; and others are used for dyeing red, yellow and green. They are distinguished by having 4 or 5, usually persistent sepals, united at base; 4 or 5 petals, alternate with the sepals, and inserted by a broad base under the edge of a fleshy disk which covers the bottom of the calyx; 4 or 5 stamens, alternate with the petals, inserted on the edge of the disk; a free ovary, immersed in the disk with 1 to 5, 1- or many-ovuled cells, and as many cohering styles and stigmas.

The fruit is 1- to 5-celled, membranous, drupaceous, capsular or fleshy, with ascending seeds.

Two genera are found in Massachusetts :

1. *Staphylèa*, with ternate leaves, and
2. *Celâstrus*, with alternate, simple leaves.

XXXII. 1. THE BLADDER-NUT. *STAPHYLEA*. L.

A genus of a few species of American and European shrubs. Flowers perfect. Sepals 5, oblong, erect, colored, persistent. Petals 5. Stamens 5. Ovary of 3 carpels united at the axis. Styles separate or separable. Fruit a membranaceous and inflated, 2- to 3-celled, 2- to 3-lobed capsule. Seeds globose, ascending, few, or, by abortion, solitary, in each cell; albumen little or none. Leaves 3- to 7-foliolate. Flowers white; the racemes sometimes paniced.

THE THREE-LEAVED BLADDER-NUT. *S. trifolia*. L.

An irregular, handsome, tall shrub or small tree, with spreading branches, growing on the borders of damp woods. It rises to the height of eight to fifteen feet, and is of rapid growth, the shoots and offsets often making five feet or more in a season. The shoots are of a light green, thickly dotted towards the base with white dots, which enlarge in the succeeding years, and give the purplish brown branch a beautifully striated appearance. The trunk is of a light gray color, with linear, white cracks. The leaves are opposite, on long, channelled, or angulate footstalks, somewhat hairy towards the end; leaflets 3, broad-oval or ovate, rather acute at base, acuminate, finely serrate, light green and smooth above, lighter and somewhat hairy beneath. The flowers are in terminal or axillary, pendulous racemes, with opposite fascicles of flowers, and linear bracts at the base of the partial footstalks. Calyx a circle of 5 oblong sepals, often tinged with pale rose color, embracing a circle of 5 obovate, reflected petals, alternate with the sepals, contracted towards the base and folding so as to form an imperfect tube, ciliate below. Five slender, thread-like filaments, opposite the sepals, with yellow anthers, show themselves above the co-

rolla, and open lengthwise towards the stigma, which is simple and supported by 3 cohering styles as long as the stamens. Fruit an inch and a half or two inches long, made up of 3 membranous capsules or pods, grown together, each ending in an awl-like point, which is the style. The pods are not unlike pea-pods in texture, and strongly resemble them in smell. The seeds are usually abortive, except, in one of the pods, a single one, which is brown, ovoid, and flattened at one end.

The seeds of the European species, which is very analogous to ours, differing from it in having 5 to 7 leaflets, are strung as beads by Roman Catholics in some countries. The wood is yellowish-white and close-grained.

XXXII. 2. THE STAFF TREE. *CELA'STRUS*. L.

A genus of nearly seventy species of unarmed, climbing shrubs, found in America, Asia, and tropical Africa. Flowers small, pale yellowish-green, in axillary or terminal, bracteated racemes. Leaves alternate, of thin texture, with very minute stipules.

Fertile and sterile flowers sometimes on separate plants. Calyx 5-lobed, forming a short tube. Petals 5. Stamens 5. Ovary 3-celled, sessile on the fleshy disk. Styles short, united, with a 3-lobed stigma. Capsule imperfectly 2- or 3-celled. Seeds 1 or 2 in each cell, enclosed in a pulpy aril. Embryo in the thin albumen, nearly as long as the seeds. Cotyledons broad and leaf-like.

THE CLIMBING STAFF TREE. WAX-WORK. *C. scandens*. L.

This is a beautiful, twining shrub, climbing over rocks, bushes and trees, often to the height of fifteen or twenty feet, and delighting in moist and shady situations. The stem is very slender, rarely more than an inch thick, preserving its size but enlarging at the angle of the branches and just below. It is of an olive green, or alder color, ash or clay-colored above, conspicuously dotted with numerous, oval, brown dots, and terminating in long and slender green shoots, with small leaves.

The leaves vary from egg-shaped to elliptic and inverse egg-shaped, acute or somewhat decurrent or rounded at base, with

a short, rather abrupt acumination, deeply serrate, often reflexed at the margin, green above, lighter below. They are from two to five inches long and one third less in breadth. Petiole rather short, margined above. The calyx is somewhat bell-shaped, with 5 yellowish-green segments; the corolla 5 greenish-yellow petals, expanding, somewhat fringed on the edge. The flowers are in terminal panicles, with small leaves at the base of the lower branches. The fruit is of an irregular globular shape, supported by the 5, rounded, thin segments of the persistent calyx, and surmounted by a short, capitate stigma, and containing an orange-colored pulp, and 2 to 6 seeds surrounded by a pulpy aril. When mature, the 3 orange-colored valves open and disclose this as a scarlet berry. The leaves turn early to a yellow. Climbing upon a chestnut, early in autumn, its orange-scarlet clusters of shining berries, and its yellow leaves, contrast finely with the bright deep green trunk and leaves of the tree.

It forms a beautiful covering for walls or trellis work, and should be cultivated for its picturesque effect. It may be propagated by seeds or by layers.

THE HORSE-CHESTNUT.

To this place belongs the HORSE-CHESTNUT TREE FAMILY, *Hippocastanaceæ*, D C., of which a detailed account is not given here, as no plants belonging to it are indigenous to Massachusetts. It is a small family, consisting of one species, the cultivated Horse-Chestnut, which is a native of northern and central India, and five or six others, (twenty, according to Spach, Hist. Nat., Vol. III, 16,) which are natives of the temperate regions of this country. They are magnificent trees or beautiful shrubs, distinguished for their showy, pyramidal flowers and chestnut-like fruit; and extremely easy of cultivation. The cultivated tree, *Æsculus hippocàstanum*, was introduced into the gardens of France in 1615 from Constantinople. It is sometimes a tree of eighty feet in height and three or four in diameter. The wood is of little value; the bark abounds in

tannin, has astringent and febrifugal properties, and may be used to dye yellow; and the fruit is saponaceous, and is eaten by sheep and deer, and, when boiled, is used to fatten cattle and fowls. In Turkey and Germany, it is employed in veterinary medicine, whence the name *horse-chestnut* and the specific name *hippocàstanum* given it by Tournefort. Of the American species, one, the Ohio Buckeye, *Æ. glàbra*, resembles the cultivated in its prickly fruit. It is a small tree with a rough bark which exhales a disagreeable odor. Of the others, which are distinguished by the smoothness of their fruits, the Sweet Buckeye of the Western and Southern States, *Æ. flàva*, with yellow flowers, is found from four to eighty feet high and with a trunk sometimes four feet in diameter. The others, *Æ. par-viflòra*, *Califòrnica*, *pàvia*, and their varieties, are shrubs or small trees.

FAMILY XXXIII. THE MAPLE FAMILY. *ACERA'CEÆ*. JUSSIEU.

This family, which contains two or three genera besides the maple, consists of trees or tall shrubs, with opposite leaves without stipules. The flowers, springing from the axil of the leaves or buds, are either perfect, or contain pistils or stamens only. On the tall trees, they are usually in corymbs; on the smaller plants, as on the Moose wood, they hang in a beautiful raceme, like a bunch of currants.

Early in the season, from a bud in which they overlie each other like tiles, usually 5, sometimes 4 to 9, sepals expand, within which and alternate to them are the same number of petals, and usually 8 distinct stamens. In the centre is a 2-lobed ovary, with 1 style and 2 stigmas. The fruit, called a samara, consists of two parts, united, with broad, nerved wings, each part containing 1 cell and 1 or 2 seeds. These are erect, without albumen, containing a curved embryo, with wrinkled, leaf-like cotyledons, and an inferior radicle.

In no part of the world are the maples of greater importance than in New England. The excellence of the wood as fuel,

the various uses in the arts to which, from its softness in some species, its hardness in others, and its great beauty in all, it may be put, the resource it furnishes in the sugar extracted from its sap, and the value of several of the species as ornamental trees, give it a place hardly second to any of the trees which cast their leaves, at least for the northern part of the country.

THE MAPLE. *ACER*. L.

The genus *Acer* is distinguished by having its flowers polygamous, that is, male, female and perfect flowers on the same or different individuals; petals colored like the sepals, but often wanting; stamens 7 to 10, rarely 5; and simple leaves.

Nearly forty species of maple are known, of which ten belong to the United States. No climate is better suited to their growth than that of New England, as is shown by the perfection to which several of the most valuable species attain here. There are several other species deserving to be introduced for their economical value and their beauty. Among these, the most conspicuous perhaps is the Large-leaved Maple, *A. macrophyllum*, of Pursh, introduced into England by Mr. Douglas from the northwest coast of North America, and described by him as a tree of the largest size, sometimes ninety feet high and sixteen in circumference, and yielding a wood soft but beautifully veined. It would doubtless flourish on this side of the continent, as would the Round-leaved Maple, *A. circinnatum*, of the Columbia River. Others are the Sycamore or Great Maple of Europe, *A. pseudo-platanus*, and the Norway Maple, *A. platanoides*, both of which grow as readily here as our own trees, and the former of which, remarkable for its rapid growth, sometimes attains to a height of one hundred feet. The Field Maple, *A. campéstre*, the common maple of the continent of Europe, the Montpellier Maple, which abounds in the south of France and in Italy and Spain; the Guelder-rose-leaved Maple, *A. opulifolium*, of the mountains of southern France, the Italian Maple, *A. ópalus*, of Corsica; the Tartarian Maple, of Russia, and the Smooth-leaved Maple of Nepaul, *A. lævigatum*, are all trees which attain more than a medium size, are sufficiently

hardy to flourish here, and have sufficient claims as ornamental trees to invite the attempt to cultivate them.

Dr. Harris describes two kinds of insects whose attacks are very pernicious to the maples. The first is the beautiful *Clytus*, (Report, p. 84-5,) a beetle about an inch in length, of a black ground color, ornamented with bands and spots of yellow. It lays its eggs on the trunk of the Sugar Maple in July and August. The grubs burrow in the bark as soon as hatched, and are there protected during the winter. "In the spring, they penetrate deeper, and form, in the course of the summer, long and winding galleries in the wood, up and down the trunk. In order to check their devastations, they should be sought for in the spring, when they will readily be detected by the saw-dust that they cast out of their burrows; and, by a judicious use of a knife and stiff wire, they may be cut out or destroyed before they have gone deeply into the wood."

The other, less injurious, is the caterpillar of the *Apatèla Americana*, (Report, p. 317,) one of the owlet moths. It feeds on the leaves of the several kinds of maple, as well as on those of the elm and chestnut.

The maples may be propagated by seeds, and in some instances by layers, by cuttings of the roots, and by grafting. Most of those of our own country have been successfully engrafted upon the sycamore of Europe. The seeds of most species ripen early; those of the Red Maple and the White, early in summer, of the others, not later than October. They may be gathered when the keys begin to turn brown; and sown in autumn, soon after gathering, or in the succeeding spring. The latter is preferable where moles or mice abound. The seeds should be covered with not more than a quarter or half an inch of soil, but the surface should be protected by leaves, straw, or some other light substance. They will come up in five or six weeks. For keeping through the winter, the seeds should be mixed with sand or earth and kept moderately dry. If kept perfectly dry and without earth, they are apt to lose their power of vegetation. The young plants are ready to be transplanted at a year's growth, and do better if moved then than afterwards.

Whenever transplanted, they should not have their heads or branches lopped, as they recover very slowly from such wounds.

Within Massachusetts, there are found five species of Maple, three of them timber trees; 1, the Red Maple; 2, the White or River Maple, the flowers of both of which appear before the leaves; 3, the Rock Maple or Sugar Maple, whose flowers appear with the leaves; and two tall shrubs or small trees; 4, the Striped Maple, with flowers in pendulous, and 5, the Mountain Maple, with flowers in upright racemes, appearing after the evolution of the leaves.

Sp. 1. THE RED MAPLE. *Acer rubrum*. L.

Figured, the leaves, in Abbott's Insects, II, Plate 93: in Audubon's Birds, fruit, Vol. I, Plate 54, flowers, I, 67.

The Red Maple, called also the White, the Swamp, the Scarlet, and the Soft Maple, is a tree of middling size, growing abundantly in the swamps and low grounds, in most parts of the State. Its flowers, which appear in April or May, before the leaves, are of a bright crimson or scarlet, and make a striking appearance in whorls or pairs, of sessile, crowded bunches, on the scarlet or purple branches. The flowers are of two or three kinds, found on different trees. They issue from opposite, somewhat quadrangular scale-buds, each bud consisting of several scales, of which the inner ones are more delicate, and containing about 5 flowers. The barren flowers are made of a cup of 8 to 10 or 12 divisions, the outer ones, the sepals, broader, the alternate, inner ones, the petals, narrower, more delicate, and often bending inwards. The stamens are 4 to 5 or 6, twice as long as the sepals, to which they are opposite, and proceeding, with them, from the outer edge of a fleshy, glandular disk. In the perfect, fertile flowers, the calyx and corolla rise from one cup, the sepals broader, external, the petals narrower, alternate, internal, sometimes fringed. The stamens 5, opposite the sepals, short, proceeding from the outer edge of a fleshy disk. The styles are 2, long, diverging, curved, the upper edge a downy stigma. The germs are 2, changing into the united samaræ or keys, with wings resembling those of an insect.

The recent shoots are of a reddish or crimson color, dotted

with brown, and changing gradually into the beautiful clear ashy gray of the trunk. In old trees, the bark cracks and may be easily peeled off in long, slender flakes. The gray, uniform color of the bark is often varied with patches of white lichens, and not uncommonly covered entirely with those of various shades of gray or white, finely dotted with their black or brown fructification. The leaves, which are plaited in the bud, where they are protected by 4 pairs of leaf-buds, are on long, round petioles, which are usually reddish, and toward autumn of a bright scarlet. They are commonly of 3 or 5 lobes, the notches between the lobes always sharp. They are usually heart-shaped, but sometimes straight or rounded at base. They vary exceedingly in size and shape, being sometimes very broad, with 5 palmately divergent lobes, sometimes long and narrow, the lower lobes reduced to mere serratures, and the middle ones prolonged and nearly parallel to the terminal one; the margin slightly and irregularly toothed, or deeply cut into long, slender serratures. The surface is liable to be variegated with lines of scarlet or to become entirely scarlet, or crimson, or orange, at every season of the year. This occasionally happens to all the leaves on a tree, even in the middle of summer, forming a gorgeous contrast with the green of the rest of the forest. The differences in the leaves are accompanied by corresponding differences in the branches and general appearance of the tree; and the common opinion is, that there are several distinct varieties of this tree. The leaves begin to change their color in August, and are usually gone by the first of November.

The observation, for a single year, of the varying colors of the Red Maple, would be sufficient to disprove the common theory that the colors of the leaves in autumn are dependent on the frosts. It is not an uncommon thing to see a single tree in a forest of maples turning to a crimson or scarlet, in July or August, while all the other trees remain green. A single brilliantly colored branch shows itself on a verdant tree; or a few scattered leaves exhibit the tints of October, while all the rest of the tree and wood have the soft greens of June. The sting of an insect, the gnawing of a worm at the pith, or the presence of minute, parasitic plants, often gives the premature colors of

autumn to one or a few leaves. The frost has very little to do with the autumn colors. Some trees are not perceptibly affected by it. The sober browns and dark reds, those of the elms and several of the oaks, may be the gradual effects of continued cold. The brighter colors seem to depend upon other causes. An unusually moist summer, which keeps the cuticle of the forest leaves thin, delicate, and translucent, is followed by an autumn of resplendent colors. A dry summer, by rendering the cuticle hard and thick, makes it opaque, and although the same bright colors may be formed within the substance of the leaf, they are not exhibited to the eye; the fall woods are tame; and the expectation of the rich variety of gaudy colors is disappointed.

The question why our forests are so much more brilliant, in their autumnal livery, than those of corresponding climates and natural families in Europe, cannot, perhaps, be fully answered. It depends, there can be little doubt, on the greater transparency of our atmosphere, and the consequently greater intensity of the light; on the same cause which renders a much larger number of stars visible by night, and which clothes our flowering plants with more numerous flowers, and those of deeper and richer tints; giving somewhat of tropical splendor to our really colder parallels of latitude.

On the first evolution of the leaves in spring, and afterwards when they expand during a series of cloudy days, their color is a delicate yellowish-green, which is supposed to be owing to the green coloring matter within the cells of the leaves, the *chromule*, or *chlorophylle*, seen through their white or yellowish membranous coverings. A few hours of sunshine give a visibly deeper tint to the green, which becomes still more intense in the clear and bright sunshine of June and July. This formation of green is found to be connected with the decomposition of the carbonic acid gas which is taken up in the sap, and the consequent evolution of oxygen, and the deposition of carbon in the vessels of the plant. The color of the *chromule* is therefore thought to depend upon its greater or less oxygenation;—a free acid, that is, an excess of oxygenation, being sometimes found in the *chromule*, when it has become yellow or red. Minute portions of iron, carried up by the sap, and deposited in the

vessels of the leaves, may possibly contribute to the depth of the colors, although some of the best physiologists doubt in regard to this.

The Red Maple is usually a low, round-headed tree, of less beauty of shape than either of the other species. But the great variety of rich hues which it assumes, earlier in the fall than any other tree, gives it a conspicuous place in our many-colored autumnal landscape. It sometimes, when growing in rich, wet land, attains to a great height and size, rising to seventy or eighty feet, with a trunk three or four feet in diameter. It has then a very rough bark.

The wood is whitish, with a tint of rose color, of a fine and close grain, compact, firm and smooth, the silver grain lying in layers very narrow and close, and the pores being very small. It is well suited for turning, and takes a fine polish; is easily wrought, and serves for a great variety of purposes. It is much used for common bedsteads, tables, chairs, bureaus and other cheap furniture. In building, it serves well for joists, is an excellent material for flooring, and may be used for any part not exposed to dampness. It lasts well in the flat of a ship's floor. It has sufficient elasticity to serve to be made into oars, which are almost equal to those of white ash. Its defects are want of strength, and its speedy decay when alternately exposed to moisture and dryness.

There are several varieties of the wood, such as the Curled Maple, the Landscape, the Mountain, the Blistered, &c. Curled Maple is the name given to a variety whose longitudinal fibres have a serpentine course, presenting, when sawn lengthwise, a varying succession of light and shade, which has a beautiful effect in cabinet work, imitating the lustre of changeable silk. It is comparatively tough and compact, while it is very light, and is used for gun-stocks and the ornamented handles of utensils. Landscape and Mountain Maple are varieties in color, caused by the irregular change from sap-wood to heart-wood. These are much used for the foot and head-boards of bedsteads, and for pannels of doors to wardrobes, &c. Blistered Maple is a rare variety, resembling the Bird's Eye of the Rock Maple. As fuel, the Red Maple is much used, burning readily and

rapidly when dry, and, for this purpose, it is five eighths as valuable as rock maple, and about half as valuable as hickory.

Bancroft says that the bark, when used with an aluminous basis, produces a lasting cinnamon color on wool and on cotton; and with sulphate or acetate of iron, communicates to them a more intense, pure and perfect black than even galls, or any other vegetable substance known to him; and that the leaves produce effects nearly similar to the bark.* Darlington says that the bark affords a dark, purplish blue dye, and makes a pretty good bluish-black ink. For both these purposes, its use is well known in this State. The sap may, like that of the other maples, be boiled down to sugar, but it is only half as rich in saccharine matter as that of the Sugar Maple.

The Red Maple is of rapid growth, young trees increasing in diameter from two fifths to two thirds of an inch in a year,—older ones somewhat less;—the average may be not far from one quarter of an inch. Though it may be made to grow in any land not too dry, it flourishes and attains its largest size only in rich swampy land.

It is found in Canada, and thence, southward to Florida, and westward to the sources of the Oregon.

Sp. 2. THE WHITE MAPLE. *Acer dasy carpum*. Ehrenberg.

Figured in Michaux, I, 213, Plate 40, and Loudon's Arboretum, V, 39 and 40.

Along the sandy or gravelly banks of clear, flowing streams, the White Maple is found all through the middle and western parts of the State. I have not yet found it nearer to Boston than the Ipswich River and the Sudbury River, in Wayland and Sudbury. On the rich meadows on Connecticut River, and on the Nashua at Lancaster, where alone I have found it growing in favorable circumstances, it expands with an ample spread of limb, forming a broad and magnificent, if not a lofty head.

From the red maple, with which it is sometimes confounded, it may be easily distinguished by the silvery whiteness of the under surface of the leaves, and by the color of the spray. The young shoots are of a light green, inclined to yellow, with

* Philosophy of Permanent Colors, II, 272.

oblong, brown dots; in the second year, they become finely striate with brown, and the dots enlarge. Afterwards, they assume the ash or granite gray of the trunk. The bark continues smooth until the tree has attained a considerable size; in old trees the trunk is rough with oblong scales, several inches in length and free at one end or both. The branches are large, gradually expanding as they ascend, but sometimes pendulous, somewhat in the manner of those of the elm.

The flowers come out early in April, before the leaves. The male flowers are in close, abundant, crowded whorls, on long footstalks. The stamens are about 6. The female flowers are somewhat less crowded. The stigma is short. The two kinds of flowers are sometimes intermingled. The pedicel of the female flower afterwards lengthens. The mature seed-vessels, or samaræ, cohere at a somewhat large angle; they are thick, and nearly two inches in length; when young, covered with yellowish hairs, but afterwards becoming nearly smooth.

The leaves, on long and slender footstalks, are often five or six inches long and four or five wide, deeply divided, usually into 5, sometimes into but 3, long lobes, tapering to a long point, each somewhat 3-lobed and deeply and sharply cut into slender teeth. The notches between the lobes are formed as if by two circles intersecting each other. The under surface of the leaves is of a silvery whiteness. The last formed leaves are remarkably and beautifully cut. The young leaves are covered with a brownish pubescence, but at length become entirely smooth.

The wood of the White Maple, is soft, white, and fine-grained, but with little strength, and very perishable. It is therefore little used where almost any other wood can be found. Its sap contains sugar, but far less abundantly than the Sugar Maple. The bark may be used with the salts of iron to form a black dye.

The beauty of the finely cut foliage, the contrast between the rich green of the upper surface of the leaves and the silver color of the lower, and the magnificent spread of the limbs of the White Maple, recommend it as an ornamental tree; and it has been extensively introduced in New York, Philadelphia and some other cities.

On the banks of the Nashua, in Lancaster, below the confluence of the two streams, in a meadow pasture on the north side, are found some old River Maples,—one, which had been much injured by the ice, in the freshets of former years, measured, in 1840, 12 feet 9 inches at the surface, 9 feet 6 inches at 3 feet, and 10 feet 4 inches at 6 feet from the ground,—a broad spreading tree.

On the meadows at Northampton, near the road from the town leading to the ferry of Mt. Holyoke, one is found which in 1837 measured 12½ feet at 3½ feet from the ground. This is a noble tree.

An old gnarled tree in a pasture meadow north of Centre Bridge, Lancaster, measured, in 1840, 18 feet 5 inches at 1 foot from the ground, the bulging roots preventing my measuring it at the surface. At 3 feet it measured 16 feet 8 inches, at 6 feet 13 feet 10½ inches. It divides at a low point into several large branches, and rises to about 60 feet. An old tree on the Atherton road measured 15 feet 10 inches near the roots, and 12 feet 4 inches at 3 feet above.

A vigorous, round-headed tree near Rev. Louis Dwight's barn in Stockbridge, measured, in 1843, 12 feet in girth at 3 feet from the ground.

Sp. 3. THE ROCK MAPLE. SUGAR MAPLE. *A. saccharinum*. L.

The leaves, flowers and fruit are well figured in Michaux, Sylva, I, Plate 42; a young tree, leaves, spray and flowers, in Loudon, Arboretum, V, Plate 37.

The Rock Maple is easily distinguished from the other maples by the roundness of the notch between the lobes of the leaves, which, in those already described, is somewhat acute. This tree, which is also called Hard Maple, from the character of its wood, and Sugar Maple, from the valuable product of its sap, is, in all respects, the most remarkable tree of the family. When young it is a beautiful, neat, and shapely tree, with a rich, full, leafy head, of a great variety of forms,—enlarging upwards and forming a broad mass above,—or tapering at each extremity and full in the middle, supported by an erect, smooth, agreeably clouded column, with a clean bark, and a cheerful

appearance of vigor. In open pastures, on moist hills and mountain sides, it forms a broad pyramidal top, the branches coming out horizontally or with a gradual upward curvature, from a point eight or ten feet from the ground. On the plain, in deep, moist, clayey soils, the top assumes the shape of a massive cylindrical column of great height, often seventy or eighty feet. In the forest, it assumes its most remarkable appearance; sometimes, from some early casualty, it is seen rising with many angles, not erect but zigzag, and with broad, rounded, oblique ridges on its trunk, sixty or seventy feet without branches, and spreading at top into a flat head of many limbs; or, more frequently, going up, from a base three or four, or even six feet in diameter, with a straight, erect trunk, disfigured, in very old trees, by gnarled protuberances, but diminishing in size very gradually, to a vast height, and there, above the tops of the other trees, throwing out a noble head of contorted and irregular but vigorous branches. The roots are large, diverging just above or at the surface of the ground, and running near it at first, but afterwards penetrating deep. The bark is of a light bluish-gray color, and, on young trees, very smooth; on old trees it is rough, with very long, ascending scales, projecting irregularly at their edges, but firmly attached at the middle or one side.

The leaves, on long, slender petioles, are from three to five inches long, and of still greater breadth. They are strongly heart-shaped, or sometimes straight at base, and palmately divided into 5 diverging lobes, which are separated by rounded sinuses, and of which the two lower ones are much smaller and shorter than the others; the lobes tapering to a slender point, and the larger veins forming a few, large, prominent teeth. They are bright green and smooth above, pale glaucous, and at first downy, afterwards smooth beneath. On different trees they differ strikingly in their color, being sometimes of a dark, and sometimes of a light green on their upper surface. In autumn, they become, often before the first touch of the frost, of a splendid orange or gold, sometimes of a bright scarlet or crimson color, each tree commonly retaining, from year to year, the same color or colors, and differing somewhat from every other.

The sterile flowers are yellowish-green, on an undeveloped branch with a pair of leaves at its base, and proceed from a long, large bud, whose oblong scales are purplish, one inch long and fringed with hairs. The flowers are pendulous, on thread-like, hairy pedicels, one or two inches long. The calyx is hairy on the edge within; petals are wanting; the stamens are about 8 or 10, twice as long as the calyx. In the fertile flowers, the stamens, about 8, are on short filaments, and the anthers are within the calyx. The stigmas are long, the ovary is conical and hairy. The fruit is borne on long, pendulous footstalks, which are either simple, or compound with several pairs of opposite branches. It is larger and fuller than that of the red maple, but not so thick as that of the river maple.

The Rock Maple is found from 48° north, in Canada, to the mountains of Georgia, and from Nova Scotia to Arkansas and the Rocky Mountains. It is most abundant in the New England States and the country immediately north and south of them. It occurs sparingly in the eastern counties of Massachusetts, but abundantly in the middle and western parts, particularly on the moist sides of the mountains and in the little valleys amongst them.

For the purposes of art, no native wood possesses more beauty or a greater variety of appearance than that of the Rock Maple. It is hard, close-grained, smooth and compact, and capable of taking and retaining an exquisite polish. The straight-grained or common variety has a resemblance to satin-wood, but is of a deeper color. The variety called Curled Hard Maple, which is caused by the sinuous course of the fibres, gives a changeable surface of alternate light and shade, exhibiting an agreeable and striking play of colors. But the most remarkable variety is the Bird's Eye Maple. This is so called from a contortion of the fibres at irregular intervals, throwing out a variable point of light and giving an appearance of a roundish projection, rising from within a slight cavity, and having a distant resemblance to the eye of a bird. All the varieties, particularly the last, are used in the manufacture of articles of furniture, ward-robres, chairs, bedsteads, bureaus, portable desks, frames of pictures, &c. The straight-grained variety is much

used in the manufacture of buckets and tubs, and is preferred to every other wood for the making of lasts. Of these, 25,000 a year are made, of this material, in one shop in Lynn. The wood of the apple tree serves as a substitute, and that of the red maple when growing in pastures: but no other wood unites, in an equal degree, the properties of softness in working, toughness, compactness, and perfect smoothness when exposed to wear.

In naval architecture, the Rock Maple furnishes the best material, next to white oak, for the keel, and by some persons it is preferred for that purpose. A very intelligent ship-builder in Maine writes me, "For keels, the Rock Maple is preferred for its superior compactness and the cohesiveness of its fibres, which lie in zigzag lines, sometimes entwining themselves in such a manner as to render it almost impossible to separate them or split the stick, which is an important consideration in a ship's keel, it being liable often to strike the bottom and rend. The durability of all kinds of wood under salt water being considered nearly or quite equal, all objection to maple on account of its tendency to decay when not constantly submerged, is obviated."

In the forest, the Rock Maple often attains great height, and produces a great quantity of timber. A tree in Blandford which was 4 feet through at base and 108 feet high, yielded seven cords and a half of wood.

As fuel, the wood of the Rock Maple holds the first place, in all those parts of New England where the hickory is not found. The ashes abound in alkali; and the charcoal made from the wood is the best in the Northern States.

Michaux says that the wood of this tree may be easily distinguished from that of the Red Maple or the River Maple, by pouring a few drops of sulphate of iron upon it. This wood turns greenish; that of the Red Maple or of the River Maple, turns to a deep blue.

In Massachusetts, between five hundred and six hundred thousand pounds of sugar are annually made, from the juice of the Rock Maple, valued at about eight cents a pound. The sap of all the maples of New England, and also of the birches, the

lindens, the hickories and the walnuts, is watery and sweet, and contains crystallizable sugar; but none so abundantly as that of the Sugar Maple.

The Sugar Maple should not be tapped before it is twenty-five or thirty years old; but the process may be repeated annually as long as the tree lives. Some trees have been tapped for more than forty successive years without apparent injury. Other trees have had their growth retarded by it. This is probably more owing to the wound necessarily inflicted, than to the loss of the sap, as it is found that the quantity and quality of the sap yielded are visibly improved after the first tappings. The quality varies with the situation of the tree. In the forest, surrounded by other trees, and having comparatively few branches and leaves, a tree yields but one pound of sugar for five or six gallons of sap; when growing in the open ground, where it is exposed to the action of the sun through the year, a tree yields a pound from four and sometimes even from three gallons. The average quantity is from twelve to twenty-four gallons each season. In some instances it is much greater. A gentleman* of Bernardston informs me that a tree in that town about six feet in diameter, favorably situated, produced, in one instance, a barrel of sap in twenty-four hours. The quantity depends also on the number of openings made in the tree.

The sap from trees growing in the maple orchards, gives an average of one pound of sugar to about four gallons of sap; varying considerably in different years. One gentleman in Bernardston made 300 pounds from 60 trees; another 400 pounds from 100 trees; a third 500 pounds from 150 trees. Some trees will give 10 pounds; some, more. Dr. Rush† cites an instance of 20 pounds and one ounce having been produced, within nine days, in 1789, from a single tree, in Montgomery Co., N. Y.; and Michaux quotes the Greensburgh Gazette as his authority for saying that 33 pounds have been made in one season from a single tree. Mr. Lucius Field, of Leverett, in-

* Henry W. Cushman, Esq., to whom I am indebted for much valuable information upon this subject.

† Dr. Benjamin Rush's Letter to Thomas Jefferson, on "the Sugar Maple Tree," in the 3d Vol. of the Transactions of the Amer. Philosophical Society, 1st series.

formed Mr. Colman, the agricultural commissioner, that in one season he obtained, from one tree, 175 gallons of sap, which, if of average strength, would have made 43 pounds of sugar.

There are different opinions as to the character of the winters most favorable to the production of sugar. Open winters are thought to cause the sap to be sweetest; and much freezing and thawing to make it most abundant and of the best quality. Michaux's inquiries led him to think a cold and dry winter most favorable. It is probable that the product depends much more on the character of the previous *summer*. A summer of plentiful rain and sunshine, that is, one which furnishes the trees with abundant nutriment and is at the same time favorable to the elaboration of the saccharine matter and its deposition in the vessels of the wood of the tree, ought naturally to prepare a plentiful harvest of sugar for the subsequent spring.

The time at which the sap begins to run freely varies with the season and with the exposure and elevation of the ground. In warm and low situations, it is earlier, in cold and elevated ones, later. It sometimes begins about the middle of February, usually about the second week in March and continues into April. A clear, bright day with a westerly wind, succeeding a frosty night, is most favorable to the flow of sap; a thawing night is thought to prevent its flow; and it ceases during a south wind, and at the approach of a storm. There are commonly from ten to fifteen "good sap days" in the sap season, which continues about six weeks. After this, in spring, and also in summer and the earlier part of autumn, sap continues to flow, but it is not rich in saccharine matter.

The sap is obtained by making an incision with a chisel and boring with a small bit, or by boring, with an augur five eighths of an inch in diameter, holes inclining upwards to the depth of from two to six inches, according to the size of the tree, and inserting a spout made of elder, or, most commonly, sumac, the pith of which being removed, leaves a tube large enough for the purpose. Several holes are so bored that their spouts shall lead to the same bucket, and high enough to allow the bucket to hang two or three feet from the ground, to prevent leaves and dirt from being blown in. The openings are usually made on

the south and east side, where the sap begins to flow earliest, and afterwards on the north side; or, more commonly, on successive sides in successive years. The sap is collected in large wooden tubs, casks, or troughs, and is evaporated by boiling over a wood fire, in iron cauldrons containing one or two barrels, or in vessels of iron or copper, 4 to 6 feet long, by $2\frac{1}{2}$ to $3\frac{1}{2}$ wide and 8 inches to 1 foot deep. Sap boiled in copper yields a whiter sugar than that boiled in iron, unless great pains are taken to keep the liquor always at the same height while boiling. The utmost neatness is important at every stage of the preparation and process. In a dry, elastic atmosphere, it takes from two to four hours to boil down a barrel of sap; and a hundred weight of sugar is said to take one cord and one fourth of wood. During the process of boiling, the sap or syrup is strained, lime or salærat^{us} is added to neutralize the free acid, and the white of egg, isinglass or milk, to cause foreign substances to rise in scum to the surface. When sufficiently boiled, the syrup is poured into moulds or casks to granulate; and the uncrystallized syrup or molasses is allowed to drain off through suitable openings. By the addition of lime and clarifying substances to the remaining syrup, it may be made to yield a further quantity of sugar, as its complete crystallization is prevented by the presence of acid, alkaline, or other vegetable matters.*

When carefully made and purified, maple sugar is identical in its composition with that from the sugar cane. From the season, and the mode of its preparation, and the character of

* A writer in the Vermont Temperance Herald, printed at Woodstock, says, "the sap should be gathered in a tub with two heads, the upper one being four inches below the top, and perforated with a hole eight inches square, with a strainer, so that all the sap shall be strained as it enters." "Even with the upper surface of the lower head," or bottom, "the tub should be pierced by an inch auger, and to the orifice a leathern tube of the same diameter affixed, long enough to reach over the top, and be fastened while gathering." "The boiling pans should come in contact with the fire only at a part somewhat less than the whole lower surface, so that the sap may not be burnt. To this end, the fire should be kindled under a permanent arch, in the top of which are openings twenty inches square to receive the boiling pans. When the sap is reduced to syrup, it should be allowed to stand ten or twelve hours, that all remaining impurities may subside, and it should be drawn off above the sediment, and placed over the fire to 'sugar off.' Throughout the whole operation, it is better policy '*to keep out dirt than to take it out.*'"

the persons engaged in the operation, it is ordinarily much cleaner than the foreign muscovado sugars, which are prepared usually by persons stupid and unclean, in the midst of insects and of decaying vegetation. It is desirable, therefore, that its product should be increased; especially as it is made at a season of the year not occupied by other rustic employments, and from trees whose presence along the borders of cultivated lands is a shelter, a protection and an ornament to the fields which they skirt.

In Stockbridge, Deerfield and many others of our most beautiful western towns, a single or double row of Rock Maples is the appropriate and magnificent ornament of some of the principal streets and roads. They elevate the public taste; they may be easily made also to contribute to sustain the public burden.

Sp. 4. THE STRIPED MAPLE. MOOSE WOOD. *A. Pennsylvanicum*. L.

Figured in Michaux, I, 245; and Loudon, Arboretum, V, 28.

This graceful little tree rarely attains to more than twelve feet in height, yet I have measured, among the Green Mountains, east of Berkshire, some stalks nearly twenty-four feet high, and a plant is now growing, within the college grounds at Cambridge, still taller. It abounds in the woods in the western and middle part of the State and in Essex County. In Maine, it is called Moose Wood, the bark and tender branches being the favorite food of the moose, and, in their winter *beats*, it is always found completely stripped. In Massachusetts, it is known by this name, and also by that of the Striped Maple.

When growing, as it commonly does, in the shade, the recent shoots are green, very smooth, hardly dotted. The branches continue of a light green, until the outer bark begins, in a year or two, to yield and cleave, the cellular substance showing itself white within, in longitudinal lines, which, afterwards turning brown, give rise to the beautifully striated appearance characteristic of the species. The leaves are opposite,—the united bases of the long, round footstalks embracing the branch,—large, ending in 3 long, acuminate lobes, sometimes 5 or 7, the primary veins being 7,—finely and sharply serrate, heart-

shaped or rounded at base, smooth, impressed at the veins above, paler and with the veinlets ferruginous, downy, or hairy beneath; cicatrix of the bud leaves conspicuous, above which are two raised lines encircling the branch. Upper leaves often long and very narrow. Clusters of fruit pendulous.

I have no doubt, from what I have observed of this beautiful tree, that it might be easily trained to a height of thirty feet. I have found it growing naturally twenty-five feet high, and nineteen or twenty inches in circumference, and Mr. Bacon, of Richmond, tells me he has known it attain the height of thirty-five feet. It well deserves careful cultivation. The striking striated appearance of the trunk, at all times, the delicate rose color of the buds and leaves on opening, and the beauty of the ample foliage afterwards, the graceful, pendulous racemes of flowers, succeeded by large, showy keys, not unlike a cluster of insects, will sufficiently recommend it. In France, Michaux says it has been increased to four times its natural size by grafting on the sycamore.

There are few uses of this beautiful little tree. In the western part of the State, where it is well known, its leaves are successfully applied to inflamed wounds and bruises.

Sp. 5. THE MOUNTAIN MAPLE. *A. spicatum*. L.

Figured in Audubon's Birds, II, Plate 134; also by Michaux, I, 253; Loudon, Arboretum, V, 30.

The Mountain Maple is a slender, small tree or shrub, usually rising eight feet or more, although it sometimes attains thrice that height, as I observed particularly in Becket. The recent shoots are of a fresh, light green, with an orange or purplish shade, somewhat downy. Those of the previous year are of a light purple, smooth, with indistinct dots, blotched and striated below with green. The branches and trunk are of a clear, light gray, striate with olive above and rough at base.

The leaves, which are heart-shaped at base, coarsely toothed, downy beneath, and divided into 3 or 5 lobes, which taper to a point, are on very long petioles, which become scarlet in September. The racemes are on the ends of the branches, the keys very divergent, and smaller than those of any other species.

The flowers are small, yellowish-green, very delicate, in an erect or nodding, slender, terminal raceme, five to six inches long. Partial flower-stalk a thread one third of an inch long. Calyx ending in 5 downy lobes, alternate with which are the slender, linear-lanceolate petals, broader at the end, half as long as the stamens. Stamens 8, rising from a glandular, yellow disk, encircling the germ, which, in the barren flowers, is replaced by a tuft of white hairs. A few of the lower flowers in each raceme are usually fertile, and in them the centre of the much smaller disk is occupied by the two-pointed germ.

This plant, like the previous one, is rarely found except in the forest. It occurs in moist, rocky, mountainous land, in all parts of the State. It assumes, towards autumn, various rich shades of red, and, as sometimes seen, eighteen or twenty feet high, hanging over the sides of a road through woods, with its clusters of fruit beneath the leaves, turning yellowish when the leaf-stalks are scarlet, it has considerable beauty. Like the previous species, it may be much improved in size by engrafting on the larger species of maple.

CHAPTER VII.

POLYPETALOUS PLANTS, WITH STAMENS AND PETALS GROWING UPON
THE RECEPTACLE.

FAMILY XXXIV. THE SUMACH FAMILY. *ANACARDIACEÆ*.

R. BROWN.

THIS order includes trees or shrubs, with a resinous, gummy, caustic or milky juice; with simple or compound, alternate leaves, without stipules, and with axillary or terminal, mostly paniced flowers. The flowers are perfect, or sterile and fertile on different plants,—distinct, regular; the calyx has 5, or rarely, 3, 4 or 7 divisions; the petals, of the same number, are inserted, as are the stamens, into the bottom of the calyx; the stamens are as many as the petals and alternate with them, or twice as many or more, sometimes sterile, anthers opening inwards. Ovary solitary, free, 1-celled; styles 1 or 3, sometimes none; stigmas as many; ovule solitary, attached by a cord to the bottom of the cell. Fruit indehiscent, commonly like a drupe; embryo curved; cotyledons thick and fleshy, or leafy.

The plants of this type have small flowers, and abound in a resinous juice sometimes acrid and very poisonous. In several, the juice is white and clammy, and afterwards turns black, and may be used as varnish. The Marking Nut-tree, *Semecárpus anacárdium*, furnishes the celebrated varnish of Sylhet; and the Theet-see, *Melanorhæa usitatissima*, that of Martaban, and probably a black lac. All these varnishes are dangerous, and when applied to the skin, often produce painful and extensive swellings. The most valuable varnishes of Japan and China are obtained from plants of this order. Mastich, and Scio turpentine, are the produce, severally, of *Pistácia lentiscus* and *terebínthus*. The seeds of the Cashew-nut, and of the Pistacia-nut are eatable, and the fruit of the Mango delicious.

Chiefly natives of the tropics; some species of *Rhus* are found

in Europe and several in North America, and this is the only genus yet found in Massachusetts.

THE SUMACH. *RHUS*. L.

A genus of about eighty species of shrubs or small trees, found in temperate regions and near the tropics, on both continents, particularly in China and Japan, at the Cape of Good Hope and in the United States. Their leaves are simple, ternate, or unequally pinnate; and their flowers, which are small, but frequently form large, showy spikes, are either perfect, or, more often, sterile and fertile on different plants. They have 5, small, persistent sepals, united at base; 5 ovate petals; 5, rarely 10, equal stamens; 1 or 3 styles; 3 stigmas. The fruit is a drupe, almost dry, often richly colored, with a bony, 1-celled nut, and a solitary seed.

Several species of sumach have a milky, poisonous juice, turning black, on exposure to air, and forming sometimes a varnish, sometimes an ingredient for indelible ink. A European species, the Tanner's Sumach, *R. coriària*, is valuable to the tanner, as is our common Stag's Horn Sumach.

Most of the species exhale a *terebinthine* odor when rubbed. Several of them contain an acrid juice, which causes painful eruptions. The precious varnish of Japan is said to be made from the juice of the Varnish Sumach, *R. vernicifera*, of that country.

Besides the native species hereafter described, the Venetian Sumach, *R. còtinus*, commonly called *Smoke-tree*, is much cultivated as a curious and beautiful plant. In Greece and Russia, it is used for tanning and for dyeing a rich, beautiful yellow, and in Italy, about Venice, for dyeing black, and also for tanning leather.

The Sumachs are much cultivated for their singularity, and the beauty of the foliage, especially in autumn, when it assumes the richest colors. The most elegant species cannot be safely admitted into gardens, on account of their poisonous qualities. The Dwarf Sumach deserves more attention than it has received. The larger species make a fine show at a distance,

and are suitable to be left in the corners of fields and along avenues. They are easily propagated by seed, and some of them by cuttings of the branches. All the species are easily propagated by cuttings of the roots.

Sp. 1. THE STAG'S HORN SUMACH. *R. typhina*. L.

This is a tall shrub, often becoming a small tree, sometimes of the height of twenty-five feet, with a diameter of four or five inches, with irregular, crooked branches. In July and August, the heads of fruit assume a rich scarlet or crimson color, afterwards turning purple, and remain conspicuous and beautiful into the winter, while, in autumn, the leaves begin early to turn, and become of a red color with various shades of yellow, orange and purple. The ends of the branches, from their irregularity and the abundant down with which they are covered, resemble the young horns of a stag, whence the name.

The flowers are yellowish-green, in a broad, tapering, branched panicle, five to twelve inches long, the common and partial stalks, like the leaf-stalks, clothed with a coarse, downy hair. Calyx short, hairy, the segments pointed, erect. Petals thrice as long, greenish-yellow, somewhat contracted at base, ovate, rounded, concave, hairy within, reflected, except at the tip. Stamens 5, short, erect, rising from the edge of a broad, orange or scarlet disk; anthers large, opening inwards, from top to bottom. Pollen orange. Stigmas 3, on green styles, from the centre of the disk.

On the fertile plants, the stamens are usually wanting or very minute, and 3 short, purple stigmas crown a velvety germ, clothed abundantly with crimson hairs. The pinnate leaflets are sessile, narrow, oblong-lanceolate, serrate, and terminate in a long point.

The wood is of a yellowish or greenish-yellow color, brittle, but of a soft, satiny texture and close-grained. The pith, which is abundant, is of a yellowish color.

The leaves and bark are astringent and used in tanning, and the root has been found efficacious in fevers. The juice is milky and abundant, very adhesive, and turning black on exposure to the air.

Sp. 2. THE SMOOTH SUMACH. *R. glabra*. L.

Figured in Catesby, Plate 104.

This is a handsome, spreading, leafy bush, usually four to six, rarely ten feet high, with irregular branches, growing by the sides of woods and enclosures, or in barren fields, in dry situations, and distinguished by its smoothness, the purple stalks of its compound leaves and a long head of yellowish-green flowers of an agreeable fragrance. The recent shoots are stout, smooth and of a shining green.

The leaves are compound, often a foot or more long, with from 13 to 19 leaflets, on a large, smooth stalk, purple where exposed to light, swelling gradually towards the base, sometimes a little hairy between the leaflets. The leaflets are sessile, oblong-lanceolate, rounded at base or heart-shaped, gradually tapering to a long point, somewhat reflexed at the margin, with a few almost obsolete serratures, or nearly entire, or acutely serrate, smooth and dark green above, glaucous beneath. Buds conical, white, woolly, concealed within the swollen base of the leaf-stalk.

The flowers are in large, much-branched heads, from six to twelve inches long, on the ends of the branches; the compound branchlets of the flower-head alternating, as if they were the continuation of the leaves. The individual, sterile flowers are on a short, somewhat hairy pedicel, greenish-yellow; calyx short, segments 5, erect, triangular or oblong and tapering, green; petals of the same length or longer, concave, hairy within, ending in a pointed beak, bent inwards. Stamens short, issuing from beneath the edge of a scarlet, fleshy disk, and bearing large anthers, opening inwards. Styles 3, scarlet, club-shaped, nearly as long as the stamens.

This plant sometimes overspreads considerable tracts in neglected fields, and by the toughness and size of its roots renders them difficult to be ploughed.

The velvety, crimson berries, are astringent, and of an agreeable acid taste, for which reason they, as well as those of *R. copallina*, are sometimes used as a substitute for lemon juice, for various purposes in domestic economy and medicine, and to

turn cider into vinegar. The acid is found to be the bi-malate of lime; and with a microscope, the crystals may be seen mingled with the down on the outside of the berries.

Prof. Wm. B. Rogers* recommends the following process for obtaining it perfectly pure:—"A quantity of hot rain water or distilled water is poured over the berries in a clean wooden or earthen vessel. After allowing the berries to macerate for a day or two, the liquid is poured off and evaporated carefully in an earthen or porcelain dish, until it becomes intensely acid. It is now filtered through animal charcoal or bone black, repeatedly washed with muriatic acid. The liquid passes through almost colorless, having only a slight amber tint. If the evaporation has been carried sufficiently far, a large deposit of crystals will form in a few hours. The liquid being poured off and further reduced by evaporation, an additional crop of crystals may be obtained, and in this way nearly all the bi-malate may be separated. The salt thus procured will often be slightly tinged with coloring matter, in which case it should be re-dissolved in hot water and crystallized anew. It is then perfectly pure."

The berries are also used in dyeing and give their own color. Kalm says, that the branches boiled with the berries, afford a black, ink-like tincture.†

The pith of this, as of the other sumachs, is very considerable. Of the wood, the outermost circles are white, the innermost of a yellowish-green. The wood burns well and without much crackling.

Sp. 3. THE MOUNTAIN SUMACH. DWARF SUMACH. *R. copallina*. L.

A beautiful plant, growing on dry, rocky or sandy hills or road-sides, usually to the height of three to five feet, but sometimes, in favorable, protected situations, to eight or ten, sometimes eighteen or twenty feet, and four or five inches in diameter.

Branches and common footstalks of the leaves and flowers pubescent, dotted with brown. Leaflets 9 to 21, nearly sessile, oval-lanceolate or oblong-lanceolate, unequal at base, rounded below often acute above, acute at the end,—the terminal leaflet

* In Silliman's Journal, Vol. XXVII, p. 295.

† Kalm's Travels, I, 75.

acuminate,—entire, polished as if varnished above, lighter and somewhat downy beneath, footstalk conspicuously winged between the leaflets, and apparently jointed; becomes a deep purple. Flowers greenish-yellow, in a terminal panicle, the lower branches of which are in the axil of leaves.

In the sterile flowers, the calyx is 5-parted, with ovate, concave, pointed, green segments. The petals of the corolla pale yellow, concave, obovate or wedge-shaped, at last reflexed. Filaments subulate, shorter than the alternate petals. Anthers attached by the middle. Pollen orange. Abortive pistil short, stigma reddish, 3-cleft, on a reddish, annular disk. The panicle of the sterile flowers is very long, twelve to eighteen inches, with the stock very downy. The sterile flowers continue to open through August, while the fertile ones are almost mature.

The fertile flowers grow in much smaller panicles, three to six inches long, on shorter and less downy branches.

Fruit a somewhat compressed, short, ovoid drupe, surmounted by the tri-fid stigma and scattered with gray dots.

The berries have the same agreeable acid as those of the Smooth Sumach, and are used for the same purposes. In Mississippi and Missouri, the leaves are used by the Indians with, or as a substitute for, tobacco.

The varnished polish of the leaves, and the rich purple they assume in autumn, as well as the scarlet of the leafy heads of fruit, make this species one of the most beautiful of the genus.

Sp. 4. THE POISON SUMACH. *R. venenata*. De Candolle.

Figured in Bigelow's Medical Botany, I, Plate 10.

I have followed Torrey and Gray in the name of this plant, as it is now ascertained that it is distinct from the true *R. vernix* of Linn., Mat. Med. and of Thunburg,—*R. verniciiflora*, D C., which it nearly resembles and with which it was long confounded.

The Poison Sumach, known also by the names of Dogwood and Poison Wood, is, perhaps, the most beautiful plant of the swamps. It rises, with a stem of light ash gray, to the height of eight or ten, sometimes of fifteen feet, with a diameter of two or three inches,—in rare instances, these dimensions are doubled,—

throwing out a few branches towards the top. The wood is brittle and the stem full of pith. The recent shoots are rather stout and tough, purple, or green clouded with purple, crowded with orange dots which soon change to an orange gray. The leaf-stalks are purple, or greenish-purple, or umber. The leaflets, 3 to 13 in number, are nearly sessile, varying from ovate to obovate, lanceolate, unequal at base, acute below, somewhat rounded above, pointed at the end or slightly acuminate, entire, margin somewhat reflexed, dark green, and with a rich polish, the veins of a purplish red above, much paler, sometimes downy, conspicuously reticulate beneath. The flowers, which are small and greenish-yellow, are in open, loose panicles, from the axils of the leaves. The sterile and fertile flowers are on different plants, the panicles of the latter eight or ten inches long, those with the sterile flowers still longer. At the base of the partial footstalks are slender, oblong, tapering bracts. The segments of the calyx are ovate, the petals usually curved; the stamens longer and alternating with them.

This is the most poisonous woody plant of New England. Some persons are so susceptible to its influence, as to be poisoned by the air blowing from it, or by being near a fire on which it is burning. The poison shows itself in painful and long-continued swellings and eruptions of the face and hands and other parts of the body. These effects are exasperated by smelling or handling the plant. Other persons handle and rub it, and even chew and swallow the leaves, with impunity. These opposite effects are sometimes produced on individuals of the same family. In some instances, persons ordinarily exempt from its effects, have been poisoned by being exposed to its influence while in a state of perspiration.

Professor Hopkins, of Williams College, informs me that he has found a decoction of the root of the Indian Poke of the low grounds, *Veratrum viride*, very efficacious as a remedy in cases of poison from this plant.

The near resemblance in all the properties of the Poison Sumach, to those of the Varnish-yielding Sumach of Japan, from which, according to Thunberg, the best varnish of that country is obtained, has led to the belief that a similar substance might

be procured from it. To this end, Dr. Bigelow made, in 1815, several experiments, which seem to establish this point in a manner very satisfactory.

"A quantity of the juice was boiled alone, until nearly all the volatile oil had escaped, and the remainder was reduced almost to the state of a resin. In this state, it was applied while warm to several substances, which, after cooling, exhibited the most brilliant, glossy, jet black surface. The coating appeared very durable and firm, and was not affected by moisture. It was elastic and perfectly opaque, and seemed calculated to answer the purposes of both paint and varnish."—*Med. Bot.*, I, 101-2.

The poisonous property, as in most cases of vegetable poisons, seems to be removed by evaporation or boiling; and the dry varnish would probably be innocuous.

Sp. 5. THE POISON IVY. *R. toxicodéndron*. L.

Figured in Bigelow's Medical Botany, III, Plate 42.

R. toxicodéndron and *radicans* of Linnæus and other authors. When climbing over rocks or on the trunks of trees, it seems to have been considered *R. radicans*; when standing by itself, and forced to erect a portion of its stem, *R. toxicodéndron*. I have never been able to find a precise distinction between the several forms of this plant, which pass into each other, and am glad to see that they are considered by Torrey and Gray as only varieties.

The Poison Ivy is a hardy plant, frequent in moist or shady places, climbing over rocks to which it attaches itself by numerous radicles which penetrate the investing lichens, or over bushes and along the trunks of trees, often to a great height, fastening itself to the bark so firmly that it breaks more readily than it is detached, and so closely as to impede the growth of the plant.

The leaves are in threes, on a petiole sometimes perfectly smooth, sometimes downy, flattened above. The leaflets are smooth and shining on both surfaces, broad-ovate, acuminate, entire or variously and irregularly toothed and lobed; the lateral ones nearly sessile, broader below, the terminal on a stalk six to eighteen lines long, or sometimes closely sessile. The sterile

and fertile flowers are on different plants, in panicles in the angle of the leaves or of the scales near the base of the recent shoots. The partial flower-stalks are very short; the calyx of the fertile flowers of 5 pointed, greenish-white segments, clasping the corolla of 5 whitish-yellow, veined, flat or reflexed, rounded or pointed segments; stamens 5, short, anthers orange, large, opening laterally; ovary ovate, with 1 large terminal and 2 smaller, lateral stigmas. The sterile flowers have a perianth of 10 pieces, the 2 or 3 outer ones short, pointed, green; the next 2 or 3, wider and longer, resembling the 5 interior, which are ovate, white veined with purple; stamens 5, with flat anthers.

This plant, as its name indicates, is poisonous in the same manner as the Poison Sumach, but in an inferior degree. As is the case with all vegetable poisons, different constitutions are differently affected by it. All persons, probably, might be poisoned by it. My brother, W. S. Emerson, a physician, who had always handled it with impunity, wishing to ascertain this in his own case, scarified his arm and applied the expressed juice to the wounds. Within twenty-four hours, the arm began to swell and be painful, and in a few days an ulcer was produced on the scarified portion, painful, of long continuance and very difficult to heal, with the remedies, acetate of lead and corrosive sublimate, recommended in Dr. Bigelow's excellent account of the plant in his Medical Botany.

The juice of this plant is yellowish and milky, becoming black after a short exposure to the air. It has been used as marking ink, and, on linen, is indelible.

Sp. 6. THE FRAGRANT SUMACH. *R. aromática*. Aiton.

This plant has quite a different aspect from any of the sumachs previously described. I have not found it in the eastern part of the State; but Prof. Dewey tells me it grows near Williams College. It has long been cultivated at the Botanic Garden, Cambridge, where it is a straggling bush, four or five feet high, with a brown, smoothish stem, and somewhat numerous branches.

The leaves are ternate on a short petiole; leaflets sessile,

oblong-ovate or obovate, or rhomboidal, ciliate on the margin, with 3 or 4 rounded or obtuse teeth on each side, very downy on both surfaces when young, leathery and smooth after mid-summer. The yellowish flowers project, on a short footstalk, from the angular, hairy-edged, brown, imbricate scales of a catkin which grows on a short stalk from the axil of last year's leaves.

In the fertile flowers, the segments of the calyx are rounded, those of the corolla more than twice the length, oblong; the stamens wanting; the disk at the bottom of the cup crenate; the ovary egg-shaped; the styles 3, short, with enlarged stigmas.

This plant is cultivated in England and France on account of the agreeable fragrance of its leaves when crushed.

FAMILY XXXV. THE PRICKLY ASH FAMILY. *XANTHOXYLA'CEÆ*. ADRIEN DE JUSSIEU.

A family of trees and shrubs, with aromatic, bitter, and pungent bark, leaves without stipules, alternate or opposite, simple, or, more commonly, unequally pinnate, with pellucid dots; and gray, green, or pink, axillary or terminal flowers. They are found most abundantly in America, particularly in the tropical regions, also in Africa and its islands and in India and China. Flowers sometimes perfect, usually fertile and barren on different plants. Sepals 3 to 9; petals as many, or wanting; stamens as many or twice as many. Seed-vessels 2 or more, on the receptacle, distinct, or more or less united; seeds 1 or 2 in each cell or seed-vessel, smooth and shining.

The only genus found in Massachusetts is

THE PRICKLY ASH. *XANTHOXYLUM*. L.

This is a genus of forty or fifty species of plants, chiefly American, and principally found within the tropics. Some of the species are powerfully sudorific and diaphoretic, and remarkable for their power in exciting salivation. Some furnish

remedies to fever; others are used in dyeing yellow; and the wood of such as grow large enough is valuable for hardness and beauty. It contains trees or shrubs, having usually prickles on the branches and on the leaf-stems and the mid-rib of the leaflets. The leaves have from 3 to 13 leaflets. The flowers are small, and greenish or whitish; the petals longer than the sepals or wanting; stamens in the sterile flowers long, in the fertile, scale-like; ovaries 1 to 5, distinct; seed-vessels crustaceous when mature, with or without a stalk, 2-valved, 1- or 2-seeded.

THE PRICKLY ASH. *X. Americànum*. Miller.

Figured in Bigelow's Medical Botany, Vol. III, Plate 59.

When growing by itself, this is a low, much-branched, round-headed shrub or small tree, with an erect stem covered with a rather smooth, light gray, or, on the old stems, dark gray bark. The recent shoots are brown, with a pulverulent surface. The buds are low, broad and round, of a crimson brown, with 2 short, sharp-pointed, stipular prickles or thorns just beneath. The leaves are made up of from 3 to 13 nearly sessile, ovate-oblong, acute, almost entire leaflets, somewhat downy beneath, and oftentimes armed with prickles, which are mostly near the base of the leaflets. The flowers expand in April or May, before the leaves, in short umbels, from the axils of the leaves. Each fertile flower has from 3 to 5 ovaries on short stalks, which, when mature, become so many 2-valved capsules, each containing a shining, blackish seed. The valves are covered with a pitted, brown or reddish rind, fragrant, when rubbed, with an agreeable, lemon-like, aromatic odor. The bark is bitter and pungent, and has been much used, in tincture, or in powder, in rheumatic affections. The wood is of a yellow color, whence Mr. Colden gave it the name *Xanthoxylum*, which signifies *yellow* wood.

I have found it growing in only one place, on a southern slope in Medford. It is there very abundant, growing single, or in little clumps or thickets, to the height of four or five feet. When cultivated, it is sometimes twenty feet high.

FAMILY XXXVI. THE LINDEN FAMILY. *TILIA*^*CEÆ*. JUSSIEU.

More than thirty genera belong to this family, including as many as two hundred species, of which five sixths are found within the tropics. More than twenty of the genera contain trees or large shrubs, but a great portion of the species are unimportant plants with pretty, sometimes beautiful, pink or white flowers. All have a mucilaginous, wholesome juice; the berries of some are eatable; all are remarkable for the toughness of the fibres of the inner bark. The wood is generally very light and soft, but applicable to important uses. They have alternate leaves with deciduous stipules; and axillary flowers with a calyx of 4 or 5 sepals, a corolla of 4 or 5 petals, with glands or scales at base, and numerous distinct stamens; the ovary of 2 to 10 united seed-vessels, with styles united and stigmas distinct. The fruit is dry, or, very rarely, like a drupe, or berry, with usually several cells, sometimes a single cell, containing one or more seeds.

The only genus of this family belonging to Massachusetts is

THE LINDEN OR LIME TREE. *TTLIA*. L.

This includes nine or ten species of trees with heart-shaped leaves, and a tough, fibrous bark, with cymose flowers, the stalk of which is attached to a large, colored, leaf-like bract. The flowers have 5 sepals, 5 petals, and numerous stamens in 5 parcels, the central one in each parcel usually transformed into a petal-like scale. The ovary is sessile, globose, villous, 5-celled; the cells with 2 ovules. The fruit is coriaceous, paper-like, or woody, nearly round, 1-celled, 1- or 2-seeded.

The species are found in the temperate regions of America, Europe and contiguous Asia; and, for the beauty of the broad, umbrageous head, the toughness and pliability of the fibres of the inner bark, the adaptedness of the soft wood to the uses of the sculptor, and the sweet fragrance of the flowers, these trees have long been familiar favorites with the inhabitants of those regions.

There are several species in Europe, by some writers considered as varieties of a single species, of which individuals are among the most remarkable trees in that region for age and size. One of unknown age, which has given its name to an ancient town in Wirtemberg, has a circumference of 54 feet, and branches extending in every direction 100 feet, and sustained by 108 wooden and stone pillars. A lime tree in Berkshire, England, known to be more than 200 years old, has a diameter of 22 feet 10 inches at 1 foot from the ground.

The honey made by bees feeding on the flowers of the European lime tree, is very excellent. An infusion of the flowers has long held, and deservedly, wide reputation as an anti-spasmodic medicine. The sap yields a considerable proportion of sugar, and is made, by fermentation, into an agreeable vinous liquor. A substance like chocolate has been made of the ripe fruit, but has the inconvenience of not continuing sweet. The wood was used by the ancients, according to Pliny, for bucklers, on account of its flexibility, lightness, and resiliency; and the bark, to cover cottages, and form baskets; and the inner bark was employed, under the name *Philyra*, to write on, and also, as in modern times, as a material for mats. The European Lime tree has been long cultivated in this country, and is perfectly adapted to our climate.

Only one species is found growing naturally in New England; three others occur in the Western and Southern States; which do not remarkably differ from ours. A beautiful variety of the European species, called the Golden-twiggèd, would be a valuable addition to our ornamental trees.

THE LINDEN TREE. LIME TREE. BASS WOOD. *T. Americana*. L.

Figured in Michaux, Plate 131; and in Loudon's Arboretum, V, Plate 24.

From a powerful root which penetrates deep or spreads wide, this tree rises to a considerable height, with an even, erect, pillar-like trunk, and many branches. When growing freely by itself, it often assumes a conical form of striking regularity. Standing, as it often does, on the side of a steep hill, with its feet almost in the water, it throws out branches horizontally,

with large, rich, thick masses of foliage, forming a beautiful and striking object when seen from a distance.

The bark is less rugged than that of almost any other tree,—except the beech;—on the young shoots, it is of a dark brown or brownish-gray color, which gradually changes, on the larger, to a light ash gray. The dark color of the young shoots, by which it is readily distinguished from the European species, has gained for it, in England and France, the common name of the Black Lime Tree.

The leaves are roundish in their outline, heart-shaped or obliquely truncate at base, inequilateral,—the side nearest the branch the largest,—acuminate, serrated with sharply acuminate serratures, smooth on both surfaces, with minute tufts of russet down at the axils of the nerves and veins beneath; of a deep green above, paler beneath, of soft, membranaceous texture, four or five inches long and equally wide. In autumn, they turn to a lemon yellow color. The leaf-stalk is half the length of the leaf, and smooth. Flower-stalk as long as the leaf, smooth, twice or thrice trichotomous at the end, rising from the upper axil of the leaf, pendulous, attached, for half its length, to an oblong, membranous, ribbon-like, pale-straw-colored bract, as long as itself. The flowers, which are from 9 to 27, are yellowish-white and very fragrant. The fruit is a woody or bony, pubescent, roundish, gray nut, one fourth of an inch in diameter, containing one seed. It flowers in July and August, and ripens its fruit in October.

The wood of the lime tree is soft and white, and of a fine, close grain. It is softer and more tough and pliable than almost any other wood, and is much used for the panels of carriages and wagons. It is also used by cabinetmakers for the bottom and sides of drawers, and for similar purposes. Where pine is scarce, bass wood boards are used as a substitute, by house-carpenters, for interior finishing. For certain purposes, it is preferable to pine, on account of its very great toughness and pliability. It is, therefore, much used by stair-builders for the curved ends of stairs. It is well adapted to carving and turning. Small boxes and wooden bowls are sometimes turned of it, and, on the Ohio River, Michaux says it was formerly employed as the material

from which the figure-heads for prows of vessels were carved. It forms a better charcoal than most of the soft woods. The charcoal made from the European lime tree, which ours very much resembles, is said to be preferred even to that of the alder, in the manufacture of gunpowder. In some parts of the country, the bark is separated, by maceration, into fibres, from which a coarse cordage is made. In Russia, mats are manufactured from the inner bark of the European tree, similarly prepared, divided into narrow strips and dried in the shade. These are often imported into this country and used for binding packages, and by gardeners for confining plants, or for tying bundles. In Sweden, the fibres of the bark serve for fishing nets; in Carniola, they are converted into a rude cloth which serves the shepherds for clothing.

The flowers of the lime tree are remarkable for their agreeable fragrance, which is often perceptible at a considerable distance. They are the favorite resort of bees, which travel some miles through the woods to reach them, by paths which seem to be as well known and as constantly traversed, as the more visible ones on the ground below. Invisible as they are, the travellers upon them are sometimes waylaid by the bee-hunters. The lime forests of Lithuania have a similar attraction for the bees of that country, which extract thence a honey said to be preferred to every other, and to command a three-fold price.

As an ornamental tree, the lime is to be recommended where the object is to obtain a great mass of foliage and a deep shade. No other native tree surpasses it in the abundance of its foliage. The appearance of the tree in winter shows the reason. The branches divide and sub-divide into very numerous ramifications, on which the spray is small, thick, and set at a large angle. This becomes profusely clothed with leaves, which are large and of a deep green. It also has the advantage of being easily transplanted and of growing readily on almost every kind of soil, though it flourishes best on a rich, rather moist, loam. These qualities adapt it admirably for being used as a screen, or as a shelter to protect more tender trees against the wind. It might, therefore, be planted to supply the place of the native forests, in situations where fruit trees are suffering from being deprived of this protection. Its growth is very rapid, it bears

pruning almost to any extent, and may be trained to grow as tall or as low and bushy as may be required.

It may be propagated by layers, by shoots, or by seed. The following method is recommended by Hunter, the editor of *Evelyn*, as successful in raising from seed :—"The seeds being ripe in October, let a dry day be made choice of for gathering them. As these grow at the extremity of the branches, it would be tedious to gather them with the hand; they may, therefore, be beaten down by a long pole, having a large winnowing sheet, or some such thing, spread under the tree to receive them. When you have got a sufficient quantity, spread them in a dry place for a few days; then having procured a spot of rich garden ground, and having the mould made fine by digging and raking, let it be raked out of the beds about an inch deep. These beds may be four feet wide, and the alleys a foot and a half. After the mould is raked out, the earth should be gently tapped down with the back of the spade, to make it level; then the seeds should be sown, at about an inch asunder, all over the bed, gently pressing them down, and covering them about an inch deep. In the spring of the year, the young plants will make their appearance; when they should be constantly kept clean from weeds, and gently watered in very dry weather. In this seminary, they may stand for two years, when they will be fit to plant in the nursery; at which time they should be carefully taken up, their roots shortened, and the young side-branches, if they have shot out any, taken off. They must be planted in the nursery ground in rows, two feet and a half asunder, and one foot and a half distant in the rows. There they may stand till they are of proper size to be planted out for good; observing always to dig between the rows every winter, and constantly to keep the ground free from weeds."

As plants raised from seed are of comparatively slow growth, the French gardeners, according to Du Hamel, employ the following mode of propagation, which may be easily practised in our native forests, where this tree is remarkable for the abundant shoots from the stumps. They cut an old tree close to the ground, which soon sends up a multitude of shoots. "Among these, they throw a quantity of soil which they allow to remain

two or three years, after which they find the shoots well rooted, and of a sufficient height and strength to be planted at once where they are finally to remain." This mode is also practised with the elm.

Hunter gives the following directions for forming layers from shoots of the American lime :—"When the layering of these is to be performed, which ought to be in the autumn, the strong two years' shoots must be brought down; and if they are stiff and do not bend readily, they must have a gentle splash with the knife near the bottom; a slit should be made at the joint for every one of the youngest twigs, and their ends bent backwards that the slit may be kept open. This being done, the mould must be levelled among the layers, and the ends of them taken off to within one eye of the ground. The business is then done; and the autumn following they will have all good roots, many of which will be strong, and fit to plant out for good, whilst the weakest may be removed into the nursery ground, in rows, to gain strength."

The lime tree is found from Canada to Georgia; most abundantly on the shores of Lake Erie and Lake Ontario. I have observed it, in almost every part of this State, sometimes growing vigorously even in the most sandy and exposed situations. It appears to be very little affected by the sea-breeze, and might, probably, without much difficulty, be made to grow on Nantucket and amongst the sands of Cape Cod.

I cannot give the dimensions of many large trees of this kind. Mr. Austin Bacon, of Natick, has favored me with the account of one of a size somewhat remarkable. It is 16 feet 6 inches in circumference at the ground, and 13 feet 4 inches at 4 feet. Near by is another of almost equal dimensions.

FAMILY XXXVII. THE ROCK ROSE FAMILY. *CISTACEÆ*.

JUSSIEU.

This family is of interest to florists and gardeners for the great beauty, variety and elegance of its flowers. It con-

tains herbs or low shrubs, with simple, usually entire leaves, generally opposite,—in a single genus partly alternate,—and with or without stipules. The flowers are perfect; yellow, white, rose-colored, or red; transient, usually lasting, except in *Hudsonia*, but a day, often but an hour. The calyx is of 5, persistent sepals, the 2 outer usually much smaller, sometimes bract-like, sometimes wanting, the 3 inner imbricated and somewhat twisted before opening. The corolla has 5 petals,—rarely 3,—sometimes none,—crumpled before opening, and twisted in a direction opposite to that of the sepals. The stamens are numerous and distinct, with short anthers. The ovary is made of 3 to 5 united vessels, surmounted by a single style and 1 or more stigmas. The fruit is a many-seeded capsule, with from 3 to 5 valves, with imperfect divisions at the middle of the valves, bearing near the central line the seeds, which are smooth and angular, with a curved or spiral embryo in the midst of mealy albumen. The properties are not known, except in certain species, which exude an odoriferous, balsamic resin, called *labdanum* or *ladanum*.

The *Cistaceæ* are mostly confined to the temperate regions of the northern hemisphere, and abound especially in the countries bordering on the Mediterranean Sea. A few species are found in Mexico and the United States. The genera found here are *Helianthemum*, *Lechæa*, and *Hudsonia*.

XXXVII. 1. THE SUN ROSE. *HELIA'NTHENUM*. Tournefort.

This genus contains a large number of beautiful species, much cultivated, delighting in dry and sunny situations, and therefore chosen, together with the Rock Rose, *Cistus*, to ornament rock-work, and plots in dry, sandy soils. The 2 exterior sepals are very small and bract-like, or wanting. The petals are 5, rarely 3, sometimes none; the stigmas 3, large, fringed, more or less united into one. The capsule is triangular, 3-valved, with few or many seeds attached to central threads or on imperfect divisions projecting into the cell.

THE CANADA SUN-ROSE. *H. Canadense*. Michaux.

Figured in Sweet's Cistaceæ, Plate 21.

Flowers of two kinds; the primary or terminal, large and petaliferous flowers few or solitary, on peduncles scarcely longer than the flower, the petals about twice the length of the calyx; secondary flowers axillary, very small, nearly sessile, solitary or somewhat clustered, on short, leafy branches, the petals very small or none, and the outer sepals usually wanting; leaves oblong or somewhat lanceolate, with revolute margins, and, as well as the sepals, and often the branches and peduncles, canescently tomentose.—*T. & G., Flora, I, 151.*

An erect, downy plant, about a foot high, found in dry, sandy places, among rocks, and remarkable for its flowers of two kinds. The earliest, which appear in May and June, are terminal or lateral, solitary, and look like a miniature yellow rose, with 3 or 5 wedge-shaped petals, and many stamens inclined to one side; the 2 exterior sepals are linear, the 3 interior broad-oval, pointed, concave, downy without. The individual flowers are fugacious, but succeed each other from day to day. The later flowers as above described.

There are two marked varieties in the neighborhood of Boston:—The one is smoothish below, with hair in scattered tufts, stem very slender, leaves rather rigid and smooth above; flowers solitary, in the angle of the upper leaves, appearing in May and June: *H. Canadense* of Pursh.

On the other, the hairs are short, densely tufted, the stem short, leaves downy or dusty on both surfaces; flowers in terminal corymbs, succeeding each other in June and July: *H. ramuliflorum*, Pursh?

XXXVII. 2. PIN-WEED. *LECHEA*. L.

An American genus of a few species of perennial, much-branched herbs with woody roots, and small, brownish-purple flowers in racemes or panicles; and entire, alternate, opposite or whorled leaves, without stipules. The sepals seem to be 3, the 2 exterior being very narrow and bract-like; the petals are 3,

small and narrow; stamens usually 3, sometimes more; capsule incompletely 3-celled, 3-valved, with 3 other apparent valves within, 1- or 2-seeded. Found on dry, rocky hills, and sunny fields.

Sp. 1. LARGE PIN-WEED. *L. major*. Michaux.

A stiff, hairy plant, with a purple, brittle, erect stem, one or two feet high. The leaves are reflexed at the margin, downy, whitish beneath. The lower branches spread on the ground in tufts, with small, roundish leaves. The stem has longer and more pointed leaves; the upper branches, lanceolate leaves; the flowers are small and very numerous, densely crowded on the sides of the upper branches, and succeeded by 3-sided, roundish capsules, about the size of a large pin's head.

Sp. 2. THYME-LEAVED PIN-WEED. *L. thymifolia*. Pursh.

A plant about a foot high, with a stout, erect stem, and numerous, somewhat whorled branches, forming a small pyramidal head, with sharp, straight, narrow leaves, the whole covered with whitish wool. It is intermediate between the last species and the next. It is found in sand on the sea-coast.

Sp. 3. SMALL PIN-WEED. *L. minor*. Lamarek.

A plant smaller than the two preceding species, resembling them strongly, but distinguished by being less hairy, by having its flowers and capsules larger, and by having a somewhat more slender and delicate appearance. The capsules are nearly globular, about the size of a grain of mustard.

XXXVII. 3. THE HUDSONIA. *HUDSONIA*. L.

An anomalous American genus of three species of excessively branched, woody, tufted, heath-like under-shrubs, with small, stiff, sessile, awl-shaped or needle-shaped, densely imbricated, persistent, downy leaves, without stipules; and small yellow flowers with reddish calyx, on the ends of very short branches. Sepals 5, united at base, the 2 outer ones awl-shaped and minute, the 3 inner oblong, expanded at flowering, forming a tube

in fruit. Petals, 5. Stamens 9 to 30. Capsule oblong-obovate, slightly 3-sided, 1-celled, 3-valved, usually 3-seeded.

Sp. 1. THE DOWNY HUDSONIA. *H. tomentosa*. Nuttall.

Figured in Sweet's Cistaceæ, Plate 57.

A creeping, under-ground stem extending to no great distance, and throwing out many long, tapering roots, branching with thread-like fibrils. The stem rises a few inches from the ground, erect or bending downwards, and throwing out innumerable short branches, thickly clothed with a sad, whitish or glaucous down, and close set leaves of the same color. Leaves very short, lanceolate, pointed, imbricate, and closely embracing the stem,—covered with down of a whitish color, through which the greener surface indistinctly appears.

Among these appear in May, yellow flowers, on very short, slender stalks, at the ends of the little branches near the extremity of the stem. The sepals look like the continuation of the leaves, being covered with down without, but yellow or reddish within. The petals are yellow. Stamens from 9 to 18, with roundish anthers. It flowers from May to July.

In some places near the coast, in Essex County, this plant covers the sand, where scarcely any other would vegetate.

Sp. 2. THE HEATH-LIKE HUDSONIA. *H. ericoides*. L.

Figured in Sweet's Cistaceæ, Plate 36.

This is much less downy than the last, and the slender, awl-like leaves, three or four lines long, spread a little, and are covered with longer and thinner hairs. It is from six to twelve inches high. The old, persistent leaves give the stem a brown color. The flowers are like those of the last species, and have from 9 to 15 stamens.

It is found in Martha's Vineyard and on Nantucket, flowering in May and after.

FAMILY XXXVIII. THE BARBERRY FAMILY. *BERBERIDACEÆ*. R. BROWN.

A family containing eleven or twelve genera of herbs or shrubs of very various appearance and character, frequently thorny, with alternate, petiolate, pinnate or simple leaves, often with spiny or pointed serratures, with yellow, white or red flowers; mostly natives of mountainous places in the temperate parts of the northern and southern hemispheres, and of the mountains of tropical America. The sepals are deciduous, from 3 or 4 to 9, in 1, 2, 3 or 4 series, often colored; the petals as many as the sepals and opposite them, or twice as many, frequently glandular or appendaged at base within; stamens as many as the petals and opposite them or twice as many, with their anthers opening with recurved valves, that is, each lobe of the anther opening at the edge throughout, except at the upper point, where it remains attached and rises to allow the pollen to escape; filaments often irritable. The ovary is solitary, 1-celled. Berry or capsule 1-celled, 1- or few-seeded.

The berries of some of the species abound in an agreeable oxalic acid; the bark of the same is bitter and astringent. Others have purgative properties.

THE BARBERRY. *BERBERIS*. L.

A genus of about forty species of shrubs, belonging to the temperate regions of both hemispheres, or to high mountains within the tropics; either with the primary leaves wanting or changed into single or compound spines in the axil of which the secondary leaves, formed by the developement of the leaf-buds and simple, are in rosettes or tufts; or with the primary leaves developed and pinnate; often with minute stipules; flowers yellow, with irritable filaments. The sepals are 9, in 3 series, the 3 exterior, small, bract-like; the petals 6, with 2 glands at the base; stamens 6; stigma orbicular, nearly sessile; fruit a 1- to 9-seeded berry with erect seeds. The wood of the root and the inner bark of the stem are of a bright yellow, and abound in

yellow coloring matter. The fruit, leaves and young shoots contain a great deal of oxalic acid ; the bark of the root is bitter and astringent.

Many of the species are cultivated in the gardens of Europe for the beauty of their flowers and foliage. Of these the most valuable are the Chinese, the Emarginate-leaved, the Nepaul, and two beautiful evergreen species, with compound leaves, natives of Oregon, and brought thence by Lewis and Clark, which would doubtless flourish in our climate. These were separated from the barberry, by Nuttall, under the name of *Mahonia*. A third, more beautiful than all, comes from the mountains of California.

All the species throw up numerous suckers, by means of which they may be readily propagated, as they may also by seed.

THE COMMON BARBERRY. *B. vulgaris*. L.

Figured in Audubon's Birds, II, Plate 188.

Every one, who is an observer of nature, must have been struck, in June, with the beauty of the arching upper shoots of the barberry, springing from a mass of rich green, and sustaining numerous, pendent racemes of splendid yellow flowers. It is hardly less attractive when its blossoms have been succeeded by clusters of scarlet fruit.

The barberry is a bush of usually four or five, but often seven or eight feet in height, and two or three inches in diameter, with a whitish or light-gray, shining bark on the recent shoots, and a much darker gray on the old stems. The principal stem is upright and very much branched towards the top. It is armed with single or sometimes triple spines, in the axil of many of which, at intervals of an inch or more, are tufts of leaves, from the centre of some of which issues a raceme of flowers. The leaves are inversely ovate, with numerous, bristly, soft serratures. It flowers in May and June, and the scarlet berries ripen in autumn, but often remain on the plant through the winter. The roots are very long and crooked, and covered with a wrinkled bark ; the wood within is of a bright orange or yellow, and very soft. The wood of the stem is also yellow ; it is hard and brittle, and little used, in this country, except in dyeing

yellow. But it is much sought for by turners, on the continent of Europe, on account of its unusual and beautiful color. The pith is white.

The barberry is found growing in exposed situations, on the borders of woods and along road-sides, in gravelly soil, in many parts of Massachusetts and New England, along the coast; as also in Canada and Newfoundland.

The remarkable irritability in the stamens of the common barberry, as well as in those of some other species, was first noticed by Kölreuter. "The stamens, when the filament is touched on the inside with the point of a pin, or any other hard instrument, bend forward towards the pistil, touch the stigma with the anther, remain curved for a short time, and then partially recover their erect position. This is best seen in warm, dry weather. After heavy rain, the phenomenon can scarcely be observed, owing, in all probability, to the springs of the filaments having been already set in motion by the dashing of the rain upon them, or to the flowers having been forcibly struck against each other. The cause of this curious action, like that of all other vital phenomena, is unknown. All that has been ascertained concerning it is this, that the irritability of the filament is affected differently by different noxious substances. It has been found, by Messrs. Macaire and Marcet, that if a barberry is poisoned with any corrosive agent, such as arsenic or corrosive sublimate, the filaments become rigid and brittle, and lose their irritability; while, on the other hand, if the poisoning be effected by any narcotic, such as prussic acid, opium, or belladonna, the irritability is destroyed by the filaments becoming so relaxed and flaccid, that they can be easily bent in any direction. It is difficult to draw from this curious fact any other inference than this, viz., that in plants, as well as in animals, there is something analogous to a nervous principle, which is more highly developed in some plants, or in some organs, than in others."—*Lindley in Loud. Arb.* 300.

The barberry is found in most parts of America and Europe. In Poland, it is used to tan leather, which it at the same time dyes a fine yellow color. The tannin principle is found in the bark, and the coloring matter both in the bark and in the wood

and bark of the root. In this Commonwealth, it is much used to give a yellow color to leather.

The leaves have an agreeable acidity and have sometimes been used as a substitute for sorrel. The berries, which are so exceedingly sour as to need no protection against birds, are sometimes pickled; they are also preserved in various ways with sugar, and then are considered pleasant and wholesome. In some parts of Europe they supply the place of lemon in flavoring punch. Bruised, they make a refreshing drink in fevers. The bark has been used for its purgative and tonic qualities,—and various parts of the plant for their great astringency.

The barberry is admirably well adapted to enter into the composition of a hedge, from the multitude of its shoots and the sharpness of its spines. There is, however, in this country as well as in England, a prejudice against it, from the belief that it produces the blight in wheat. Prof. Martyn urges against this opinion, the fact that it abounds in the hedges in Saffron Walden, in Essex, England, which enclose fields in which wheat is cultivated constantly and with entire success. And Dr. Greville, in his *Scottish Cryptogamic Flora*, has shown that the mildew which attacks the barberry, (*Æcidium berberidis*), is quite different from the fungus which occasions mildew in wheat, which is a kind of *Uredo*, entirely remote in its botanical characters from an *Æcidium*.

In the neighborhood of Boston the barberry propagates itself readily and rapidly by seed and by the multitude of suckers which it throws up. In those parts of the State in which it has been found by experience that wheat is not a profitable crop, there can be no objection, on the score of its danger, to the use of the barberry as a hedge. The beauty of the plant, the rapidity of its growth when young, its durability,—for a stock, though so easily established, lives very many years,—Loudon says, one or two centuries,—the sharpness and great number of its prickles, the closeness with which it springs up, and the readiness with which it submits to the knife, are strong recommendations. On some lanes in Brookline and other places in the vicinity of Boston, a natural hedge of barberry, sweet briar, wild rose and privet has formed a most graceful border for the road-side.

This, which gives an air of wildness and retirement perfectly suited to the purpose for which much of this suburb is used, has in several places been made to give place to the stiff, pudding-stone wall;—and the change is called *improvement*.

If the suckers and lower branches are removed, and only the upper branches allowed to grow, the barberry forms a very beautiful little tree, and sometimes shoots to the height of ten feet. At times we find such a tree by the road-sides, surprising us by its gracefulness and the beauty of its bright yellow flowers in June, and of its rich scarlet berries and its fading orange-scarlet leaves in autumn.

FAMILY XXXIX. THE MOONSEED FAMILY. *MENISPER-
MA'CEÆ*. JUSSIEU.

A family of about one hundred species mostly of twining shrubs, belonging almost entirely to the torrid zone; with simple, rarely compound, palmately veined leaves without stipules; and minute flowers in panicles or racemes. Male and female usually on separate plants; sepals 3 to 12, in one, two, or three rows, deciduous; petals half as many or as many as the sepals and opposite them, sometimes united, rarely wanting; stamens as many as the petals and opposite them or two to four times as many, distinct or united, anthers 1-, 2- or 4-celled; ovaries 1 or more, 1-celled. The fruit is a 1-seeded, lunate drupe, containing a bony nut, with the embryo usually curved.

Many of the species are remarkable for their astringent and tonic properties, which render them valuable remedies in fever and in dysentery. One of the most important of these is Colombo root, from the *Cocculus palmatus*, a native of Mozambique. The seeds of other species are narcotic, like *C. Indicus*, used to poison or intoxicate fishes; while the fruits of others are eatable.

MOONSEED. *MENISPERMUM*. L.

Climbing shrubs of North America and Central Asia, with alternate, peltate, or heart-shaped, smooth, entire leaves, and small, yellowish flowers in axillary or supra-axillary racemes. The male flowers have 4 to 12 sepals in two to four rows, as many petals or none, and 10 to 30 distinct stamens with 4-lobed anthers; the female flowers, somewhat larger, 4 to 6 sepals in two rows, as many petals, and 2 to 4, 1-celled ovaries. The drupes are solitary, or in twos or fours.

CANADA MOONSEED. *M. Canadense*. L.

A twining plant, with a smooth, woody stem, eight to twelve feet long, climbing over shrubs, on the banks of rivers and in thickets. The leaves are peltate or shield-like, three or four inches long, and rather broader, with 3 to 5 angular lobes, with the leaf-stem, which is one or two inches long, inserted near the base, bright green above, pale and very strongly nerved beneath. The flowers are greenish-yellow, in small racemes, which come out a little above the axil of a leaf. The fruit is a drupe, nearly black when mature, and containing a lunate nut.

FAMILY XL. THE MAGNOLIA FAMILY. *MAGNOLIACEÆ*.

JUSSIEU.

This family comprehends about fifty species of trees and shrubs, among which are many of the most magnificent of the vegetable kingdom. They abound in tropical Asia and the warmer parts of North America. This State is their most northern limit. Advancing southward, they become more numerous, and reach their highest perfection in the Southern and Southwestern States. A few are found in the West Indies and in South America, and in Japan, China, New Zealand and New Holland. Their leaves are large and showy, alternate, simple, coriaceous, mostly very entire, dotted most frequently with pellucid dots, and, before

opening, protected by 2 ample, deciduous stipules, convolute and terminating the branches with a conical point, and when fallen, leaving a lasting annular mark. The flowers are of extraordinary size and splendor, and generally exhale a delicious fragrance, which often acts powerfully upon the nerves. Almost every part of the plant, especially the bark and the fruit, is highly aromatic and tonic, the bark containing a bitter principle, which has often been used as a substitute for Peruvian bark, on account of its stimulant, stomachic, febrifugal properties.

The flowers are distinguished by having a calyx of 3 or 6 sepals, which fall as they expand; a corolla of from 3 to 30 petals usually disposed in threes; very numerous stamens with long, close anthers; and 1, a few, or, most commonly, very many ovaries arranged on a central cone. The fruit consists of numerous 1- or 2-seeded vessels, aggregated or grown together like the strobile of a pine; embryo minute, at the base of fleshy albumen.

Of this family, there are two genera found growing in Massachusetts; the

Magnolia, distinguished by its seed-vessels opening to allow the escape of the seed; and

The Tulip Tree, *Liriodéndron*, with seed-vessels not opening; and with leaves truncate at the end.

XL. 1. THE MAGNOLIA. *MAGNOLIA*. L.

This genus, named for Magnol, a distinguished botanist of Montpellier, in France, contains trees, except *M. glauca*,—which in the Northern States is only a shrub,—all of them beautiful and some of them among the finest and most splendid trees that are known. It is distinguished by having a calyx of 3 caducous sepals, resembling petals, and a corolla of 3 to 12 deciduous petals. The carpels are 1- or 2-seeded, opening by the external angle, and permanent, and forming a fruit like the cone of a pine. The seeds are like a berry, somewhat heart-shaped, and hanging suspended, when ripe and escaped from the carpel, by a long, slender thread.

There is only one species known as naturally growing in

Massachusetts; but several others, and those among the most beautiful, may be cultivated.

The Cucumber Tree, *Magnolia acuminata*, is found, according to Dr. Torrey, in New York, and may, probably, hereafter be found, scattered in favorable situations, in the western part of the State. It grows perfectly well at the Botanic Garden, at Cambridge. Michaux says it is one of the most magnificent trees in North America. Its large flowers, five or six inches across, are very conspicuous, among its ample foliage, as is its cylindrical fruit, three or four inches long, with the scarlet seeds depending from it. But its branches are long and bare, except at the end, and it wants much of equalling in grace, fulness and beauty, the greater part of our forest trees.

A much more beautiful tree, as it grows here, for shape, foliage and flowers, is the Long-leaved Cucumber Tree, *M. auriculata*. It grows readily, but attains not a great height.

The Three-petalled, the Heart-leaved, the Yulan and the Purple may also be cultivated. They are propagated by seed, by layers or by inarching, and, while young, are best preserved in pots.

THE SMALL MAGNOLIA. SWAMP LAUREL. *M. glauca*. L.

Figured in Michaux, Sylva, II, Plate 52; in Bigelow's Medical Botany, II, Plate 27; and in Catesby's Birds, Plate 39.

A sheltered swamp near Cape Ann, not far from the sea, is thought to be the most northern habitation of this plant, and until lately was supposed to be the only one in Massachusetts. It has recently been found at the distance of some miles, in another swamp, in the midst of deep woods in Essex. From these situations it will soon be completely extirpated. The fragrant flowers and even the leaves are in such request, that early in the flowering season, numbers of persons resort to the swamps in quest of them, and great quantities are annually carried to Salem and Boston for sale. The gatherers of the flowers are regardless of the preservation of the trees, and in a single season I have noticed scores of them broken down and almost entirely destroyed.

Few ornamental plants are better worth the attention of the gardener. Carefully trained, it forms a beautiful little tree. The

bark on the young shoots is smooth and of a rich apple-green, becoming afterwards of a soft glaucous or whitish color. Before opening, the leaves are enclosed by the stipules, which, falling, leave rings encircling the branch; when young, the leaves are covered with a pubescence, which, beneath, has a silken lustre. They are entire, elliptical, or slightly obovate, on short, tapering petioles, and, when mature, smooth, and light green above, pale-glaucous beneath, and of a soft, leathery texture. The mid-rib is prominent beneath, for the whole length of the leaf. The calyx of the solitary, terminal flowers, consists of 3 concave, obovate, membranaceous sepals, resembling petals, but less delicate in texture. The corolla has usually 9 delicately white petals, tapering at base, and rounded at the extremity, arranged in 3 circles, and mutually enfolding each other before expansion. The stamens are very numerous, 80 to 100 or more, in spiral lines on the conical, green torus, or receptacle,—3 or 4 of the outer ones often partly turned into petals. Anthers very long, yellow, pointed, set upon the inner side of the short filament and opening inwardly. Styles many, on a conical receptacle; stigmas long, yellow, turned back at the tip, and rising much above the ends of the long anthers. The fruit is a cone about two inches long, covered with scale-like, imbricated ovaries, from which, when mature, escape the scarlet, obovate seeds, which, instead of falling at once to the ground, remain some time suspended by a slender thread.

No plant is, at every season and in every condition, more beautiful. The flower, two or three inches broad, is as beautiful and almost as fragrant as the water lily. Like most other plants, growing naturally in wet ground, it may easily be made to thrive in dry, but will not then continue long in flower. In moist situations, particularly if protected through the winter by a covering of boughs or mats, it continues to produce its flowers to the end of the warm season.

Like other plants of this genus, the Small Magnolia possesses valuable properties as a tonic and as a warm stimulant and diaphoretic; and it has been used with great success in chronic rheumatism, in intermittent fevers, and particularly in fever and ague. To secure the virtues of the plant, a tincture should be

made of the bark or cones, while green, and before the volatile parts have escaped.*

The small magnolia may be propagated by layers, which require two years to root sufficiently, and by seed. The seed should be preserved in moist bog earth, and sown very early in spring, in earth of the same kind.

XL. 2. THE TULIP TREE. *LIRIODÉNDRON*.

A genus of a single species, found only in North America. The calyx is of 3 sepals which fall at the same time with the petals; the lily-like, bell-shaped corolla, of 6 petals in two rows; the stamens are very numerous, as are the small, imbricated, 1- or 2-seeded, winged ovaries or seed-vessels.

THE TULIP TREE. *L. tulipifera*. L.

Figured in Catesby's Birds, Plate 48; Michaux, Sylva, II, Plate 61; Abbott's Insects of Georgia, II, Plate 102; Bigelow's Medical Botany, Plate 31; Audubon's Birds, I, Plate 12.

The tulip tree is a tall, stately, upright tree, with a magnificent, columnar trunk and an open head, rounded above. It spreads little towards the root, but has large limbs, stretching strongly upwards and throwing out branches at all angles. The bark of the trunk is of a dark ash color, with very numerous, small, superficial rugosities, though, when seen at a distance, it has a somewhat smoothish appearance. The recent shoots are of a bright brown, or chestnut color, smooth, with a grayish bloom-like dust upon it, and distant, narrow dots. The older branches are brown, and seem as if covered with a transparent membrane.

The terminal bud is formed by the two stipules cohering by their edges,—into an oblong, rounded, purse-like sheath. On opening this, a minute leaf is found, bent down and folded together in a single fold, by the side of another, smaller sheath. When opening naturally, the stipules expand and protect the leaf till it attains its full size, when they are an inch or two long, of a yellowish-green color, oblong, broader towards the

* Bigelow, American Medical Botany, II, 71.

end, rounded, with a minute point. They then fall, leaving a slight annular scar, above the base of the leaf.

The leaves are on long, angular footstalks, very large at base. They are 4-lobed, the lobes ending in rounded or sharp points, and separated by broad, shallow sinuses. The terminal lobes end abruptly, as if the extremity of the leaf had been cut off. In large leaves, each of the lobes is occasionally divided into 2, and the lower ones sometimes into 3 or more partial lobes or large teeth. In some varieties, the points of the lobes are obtuse. The leaves are smooth, and of a light green above, glaucous or whitish beneath, with downy nerves, and finely reticulated veins.

The large, solitary flowers have the shape, size and appearance of a lily. They are contained in a sheath of 2 triangular leaves, which are thrown off by the expansion of the flower. The sepals are of a greenish color, striate or veined and dotted, sub-coriaceous in texture, concave and spreading, afterwards bending back. The petals are also striate or veined and dotted, of a greenish-yellow, somewhat fleshy in texture, and marked towards the base with a crescent-shaped spot of bright orange. In the centre is a large, conical, pointed pistil, surrounded by numerous stamens with long anthers.

The bark of the root and branches of the tulip tree is remarkable for its pungent, bitter and aromatic taste, and agreeably aromatic odor, and acts on the system as a stimulating tonic, as a diaphoretic and as a sudorific. It has been successfully employed in the treatment of chronic rheumatism and intermittent fever. The useful properties are most completely extracted by alcohol.—*Big. Med. Bot.*, II, 111.

The wood of the tulip tree, under the name of white wood, is extensively used in every part of the country. In the Western States, it supplies, in a great degree, the deficiency of pine, and is used by the joiner, as a substitute, in the inner wood work of houses. In New England, it is preferred to other kinds of wood in all uses which require great flexibility, as about stairs, for the wash-board in circular rooms and for the pannels of carriages; also for the bottom of drawers, and for pannels in common wardrobes and other small articles. It is remarkably

white, soft, smooth, fine-grained, and is very easily wrought, and bent to any required shape. It comes into Massachusetts from New York, usually in square cornered boards 3 feet wide and 12 feet long.

Considerable numbers of this tree are found in several towns on Westfield River, particularly in Russell. It is also found native, very rarely, in the eastern part of the State.

The tulip tree is found abundantly in Canada West, and the Western States, where it sometimes reaches the height of 120 or 140 feet with a diameter of 5 or 6. In New England, and along the Atlantic coast to Florida, it does not reach these ample dimensions, but is still a very noble tree. Michaux thinks that, next to the buttonwood, it attains, in favorable situations, in a deep, cool, moist soil, the largest size of any tree in the United States.

The tulip tree is readily propagated by seeds, which require a fine, soft mould, and a cool and shady situation. If sown in autumn, they come up the succeeding spring, but if sown in spring, they often remain a year in the ground. Varieties are propagated by layers or by budding or grafting. This tree, like the magnolias, has few fibres on its roots, and is, therefore, not readily transplanted.

SECOND GENERAL DIVISION.

CHAPTER VIII. MONOCOTYLEDONOUS PLANTS.

THIS division is of little comparative importance in extra-tropical regions. In this State, it is represented by a few families of humble plants, among which are, however, the grasses and those which produce the various kinds of corn and grain. The noblest of monocotyledonous plants, the palms, are confined to the warmer climates.

The stem of monocotyledonous plants is not composed of distinct pith, wood and bark, the two latter arranged in concentric rings or zones and traversed by medullary rays, but of bundles of vessels and woody fibres traversing the stem somewhat irregularly from the base of the leaves to the roots or to points near the surface of the stem. The leaves have ribs and veins nearly parallel, and are not usually articulated to the stem, but continuous, so that, when they wither and decay, they leave a ragged, indefinite, partial stalk, instead of the well-marked scar left by the fall of the leaf of a dicotyledonous plant. The parts of the flowers are in threes or multiples of three. The embryo of the seeds is undivided, and has a single lobe or cotyledon, and a single radicle.

FAMILY XLI. THE SMILAX FAMILY. *SMILACEÆ*. R. BROWN.

This small family, the only one containing monocotyledonous plants which in our climate have woody stems, includes plants differing considerably in aspect, habits and duration. To it belong the small, herbaceous annuals, *Trillium*, *Medæola*, *Streptopus*, *Convallaria* and *Uvularia*, and the woody, climbing plants of the genus *Smilax*. It is found principally in Asia and North America. It is characterized by having the calyx and corolla usually confounded, of six parts resembling petals in being colored; 6 stamens; style trifid; 3 stigmas or a 3-parted stigma, and the fruit a roundish berry.

The properties are various. Sarsaparilla, well known for its diuretic, demulcent and diaphoretic powers, is the root of one or several species of *Smilax*; and other species are known to have similar properties. Dr. Barton found the same in the root of *Medæola Virginica*. Some species of *Trillium*, remarkable for the three-fold arrangements of its parts, its 3 leaves, 3 sepals, 3 petals, twice 3 stamens, 3-celled ovary, and 3 styles, have nauseous berries and violently emetic roots. The large fleshy roots of China *Smilax* are eaten in the Celestial Empire instead of rice, and supposed by the Abbé Rochon to contribute to the corpulency of the Chinese. A reddish powder is obtained by maceration in water from the roots of the same plant, and, with boiling water, forms a jelly, which, sweetened with honey or sugar, is used as an article of food, according to De Candolle, in the southern parts of North America.

THE GREEN BRIAR. *SMILAX*.

The different sexes on different plants. The flowers have a perianth of 6 parts. In the male flowers, the 6 stamens have their anthers laterally attached. The fertile flowers have a minute style, 3 stigmas, and produce a berry with 3 cells, and 1 to 3 seeds in each. They are often climbing, prickly plants; sometimes herbaceous. The stem of the leaf has a tendril on each side. Flowers transient in axillary umbels.

The genus contains nearly fifty species, of which fourteen, according to Nuttall, belong to North America. Two are found in Massachusetts:

The Round-leaved Green Briar, known by its climbing, round, thorny stem; and

The Carrion Flower or Herbaceous *Smilax*, known by its angular, nodding stem, and the intolerable smell of its flowers.

Sp. 1. ROUND-LEAVED *SMILAX*. GREEN BRIAR. *S. rotundifolia*. L.

Figured in Audubon's Birds, I, Plate 57.

This is a beautiful but very troublesome vine, climbing with a smooth, yellowish-green stem, from clump to clump, and from tree to tree, to the distance often of thirty or forty feet.

The stem is woody, strong, very tough, flexuose, somewhat branched, and smooth, except where armed with short, straight, rigid thorns which proceed from the wood. Branches somewhat 4-angled. Leaves unarmed, orbicular, heart-shaped at base, 5-nerved, ending in a short point, paler and glaucous beneath, two or three inches long, and of equal breadth, and reticulate in their structure. Footstalks short, margined, with a slender but tough tendril from the extremity of the margin on each side. The flowers, which appear in June, are small, yellowish-green, in roundish umbels, on short stalks, from the axils of the leaves. Berries small, bluish-black, with a glaucous bloom; disagreeable to the taste, ripening in October. The root is long and tough, and thickens sometimes into tubers. The Green Briar abounds in moist grounds, especially where the trees have been wholly or partially cut off. The leaves are of a beautiful soft green, which in October turn to a deep yellow, and in November to a rust color.

Sp. 2. CARRION FLOWER. HERBACEOUS SMILAX. *S. herbacea*. L.

A smooth, erect or leaning, herbaceous plant, from a woody, perennial root. Stem three to eight feet long, smooth, unarmed, somewhat angled, often reddish, attaching itself to other plants by its thread-like tendrils; simple, or with a few small branches. Stem leaves two or three inches long and one or two wide, heart-shaped or somewhat acute at base, pointed, entire, 7- or 9-nerved, smooth above, downy on the nerves and veins beneath. Leaf-stalk half as long as the leaf, winged at base, with a slender tendril terminating each wing. Branches few, from the axils of the stem-leaves, bearing a few narrower and smaller, 5-nerved leaves. Flowers appear in June and are small, yellowish-green, in small, round umbels, and of a very offensive odor. The staminate flowers are on a short footstalk; the fertile ones on stalks six or eight inches long, and succeeded by small, compressed, dark blue berries. The odor of the flowers is fugacious and does not adhere to the dried specimens.

EXPLANATION OF THE PLATES.

- PLATE 1. The White Oak. *Quercus alba*. Fig. 1. A leaf and acorns of the natural size. 2. A leaf of half the natural size. 3. Male flowers and leaves. 4. A single flower magnified, showing the 6 stamens, and the parts of the perianth. 5. Section of an acorn, of the natural size, showing the 2 large cotyledons occupying almost the whole cavity of the shell, and between and above them the radicle pointing towards the upper end of the shell, from which it is destined to issue, showing that the *radicle* is *superior*.
- PLATE 2. The Overcup White Oak. *Q. macrocarpa*. Leaves and fruit.
- PLATE 3. The Rough Oak or Post Oak. *Q. stellata*. Leaves and fruit.
- PLATE 4. The Swamp White Oak. *Q. bicolor*. Leaves and fruit.
- PLATE 5. The Chestnut Oak. *Q. castanea*. Leaves and fruit.
- PLATE 6. The Rock Chestnut Oak. *Q. montana*. Leaves and fruit.
- PLATE 7. The Black Oak. *Q. tinctoria*. Leaves and male flowers.
- PLATE 8. The Black Oak. *Q. tinctoria*. Leaf and fruit.
- PLATE 9. The Scarlet Oak. *Q. coccinea*. Leaf, fruit and female flowers.
- PLATE 10. The Red Oak. *Q. rubra*. Leaf, fruit and female flowers.
- PLATE 11. The Bear Oak. *Q. ilicifolia*. Leaves, fruit and female flowers.
- PLATE 12. The Shellbark Hickory. *Carya alba*. Leaf, fruit and male flowers.
- PLATE 13. The Mockernut Hickory. *C. tomentosa*. Fruit and (a) male and (b) female flowers of the natural size; leaf reduced.
- PLATE 14. The Pignut Hickory. *C. porcina*. Leaf and fruit.
- PLATE 15. The Bitternut Hickory. *C. amara*. Leaf and fruit.
- PLATE 16. The Nettle Tree. *Cellis occidentalis*. Leaves, fruit, and flowers.
- PLATE 17. The Tupelo Tree. *Nyssa multiflora*. Leaves, fruit and (a) male and (b) female flowers.

INDEX.

NOTE.—The botanical names of species, not native, are in *italics*.

Abies,	page 77	American arbor vitæ,	96
alba,	84	aspen,	243
Canadensis,	77	beech,	158
nigra,	81	chestnut,	164
ABIE'TINÆ,	60	elm,	286
Acer,	481	hazel,	171
<i>campêtre</i> ,	481	hop hornbeam,	177
<i>circinatum</i> ,	481	hornbeam,	174
<i>dasycarpum</i> ,	487	laurel,	390
<i>lævigatum</i> ,	481	mountain ash,	439
<i>macrophyllum</i> ,	481	nettle tree,	306
<i>opalus</i> ,	481	Ampelopsis quinquefolia,	471
<i>opulifolium</i> ,	481	AMYGDALÆ,	446
Pennsylvanicum,	496	ANACARDIACEÆ,	499
<i>platanoides</i> ,	481	ANDROMEDA Tribe,	371
<i>pseudo-platanus</i> ,	481	Andrómæda polifolia,	372
rubrum,	483	ANDROME'DEÆ,	371
saccharinum,	489	Antiæris,	279
spicatum,	497	APPLE Family,	430
ACERA'CEÆ,	480	Apple,	438
Æ'sculus Californica,	480	AQUIFOLIA'CEÆ,	340
<i>flava</i> ,	480	Arbor vitæ,	96
<i>glabra</i> ,	480	Arctostáphylos uva ursi,	381
<i>hippocastanum</i> ,	479	Arrow wood,	366
<i>parviflora</i> ,	480	maple-leaved,	367
<i>pavia</i> ,	480	ARTOC'ARPEÆ,	279
Alder,	217	Ash Tribe,	332
black,	344	Ash,	332
common,	218	black,	338
single-berry black,	345	red,	337
speckled,	220	white,	333
Alder-leaved buckthorn,	474	Azàlea,	387
Cléthra,	377	nudiflora,	389
ALMOND Family,	446	Póntica,	383
Alnus,	217	viscôsa,	387
incana,	220	Balm of Gilead poplar,	245
serrulata,	218	Balsam fir,	85
Alternate-leaved cornel,	409	BARBERRY Family,	520
Amelanchier,	442	common,	520
botryâpium,	443	Barks for tanning,	20
Canadensis,	443	Bass wood,	511
ovâlis,	444	Bayberry,	224
AMENTA'CEÆ,	113		

Beach plum,	449	Brittle willows,	263
Beaked hazel,	173	Broad-leaved <i>Ledum</i> ,	396
willow,	274	<i>Broussonetia papyrifera</i> ,	282
BEAN Family,	456	Browsing of cattle hurtful to trees,	31
Bear berry,	381	Buckeye,	480
Bear oak,	150	Buckthorn,	473
Beauty of the forests,	7	BUCKTHORN Family,	472
Bedford willow,	266	Buffon's mode of felling,	34
Beech,	158	Bullace plum,	448
copper,	163	Bunch berry,	415
purple,	163	Bush honeysuckle,	359
Bénzoin odoriferum,	324	whortleberry,	400
BERBERIDA'CEÆ,	520	Butternut tree,	182
Bérberis vulgaris,	521	Button bush,	349
Bétula,	202	Buttonwood tree,	227
alba,	215		
excelsa,	206	CACTA'CEÆ,	423
glandulosa,	216	CACTUS Family,	423
lenta,	203	Californian plane,	227, 237
nigra,	208	<i>Camphora officinalis</i> ,	318
papyracea,	210	Canada Judas tree,	465
populifolia,	213	moonseed,	525
BETULA'CEÆ,	201	plum,	449
Bignônia,	407	Rhodora,	390
BIGNONIA'CEÆ,	407	Canoe birch,	210
BIRCH Family,	201	CAPRIFOLIA'CEÆ,	352
Birch,	202	CARPINA'CEÆ,	174
black,	203	Carpinus Americana,	174
canoe,	210	Carrion flower,	534
dwarf,	216	Carya,	187
planting with,	214	alba,	191
red,	208	amara,	199
sweet,	203	porcina,	197
white,	213	tomentosa,	194
yellow,	206	Cashew nut,	499
Birch canoes,	211	Cassandra calyculata,	373
Bird's eye maple,	491	Castanea,	163
Bitternut hickory,	199	vesca, var. Americana,	164
Black alder,	344	Catalpa,	408
ash,	338	Catawba grape,	465
birch,	281	Causes of the color of leaves,	484
cherry,	453	Ceanothus Americana,	475
currant,	419	Cedar,	96, 98
mulberry,	281	red,	102
oak,	141	white,	98
spruce,	81	Cedar apples,	106
swamp whortleberry,	402	Cedar of Lebanon,	95
walnut,	185	Cedrus Libani,	95
whortleberry,	398	CELASTRA'CEÆ,	476
willow,	271	Celastrus scandens,	478
Blackberry,	429	Celtis,	306
Bladder nut,	477	crassifolia,	309
Bland's grape,	468	occidentalis,	306
Blistered maple,	486	Cephalanthus occidentalis,	349
Blueberry, low,	403	Céraserus Pennsylvanica,	451
Blue whortleberry,	402	pumila,	453
Bog willow,	258	serotina,	453
Boxberry,	379	Virginiana,	456
BRAMBLE Tribe,	428	Cercis Canadensis,	465
BREAD-FRUIT Family,	279	Chequer berry,	380
Bristly raspberry,	429	Cherry,	451
Brittle gray willow,	262	black,	453

Cherry, choke,	456	Crack willow,	264
northern red,	451	Cranberry,	405
sand,	453	high,	368
wild black,	455	tree,	368
Chestnut,	163	Cratægus,	430
improving by cultivation,	166	coccinea,	434
Chestnut oak,	137	crus-galli,	433
Chicken grape,	470	punctata,	435
Chiógenes,	406	tomentosa,	435
hispídula,	407	Creeper,	471
Choke berry,	441	Creeping Mitchella,	351
cherry,	456	Crowberry Family,	327
<i>Cinnamónum zeylánicum</i> ,	318	Cucumber tree,	527
Cinnamon Family,	317	Cupréssus,	98
Clamoun,	392	disticha,	49
Clethra alnifolia,	377	thuyoides,	98
Climbing staff tree,	478	CUPULIFERÆ,	113
Cluster pine,	76	CURRENT Family,	419
Clustered Zenobia,	376	black,	419
<i>Cócculus 'Indicus</i> ,	524	large-flowering,	422
<i>palmatus</i> ,	524	red,	419
Cockspur thorn,	433	Missouri,	419
Coffee,	347	mountain,	422
Coffee tree, Kentucky,	465	Cydônia,	446
Colors of leaves,	8, 485	Cypress,	98
Columbo root,	524	Cypress Tribe,	96
Common barberry,	521		
American rose bay,	384	Dangle berry,	399
bear berry,	381	Deer berry,	401
buckthorn,	473	Dense-flowered early willow,	260
cranberry,	405	Description of the flower and fruit,	37
elder,	362	DICOTYLEDONOUS plants,	45
European elm,	299	Diervilla trifida,	359
gooseberry,	419	Dirca palustris,	325
grape,	467	Distribution into families and genera,	37
locust tree,	460	era,	37
witch hazel,	416	Division into families,	39
Comptónia asplenifolia,	225	Division into genera,	42
CONIFERÆ,	47	Dogwood,	504
Copper beech,	163	flowering,	413
Cordate willows,	275	Dotted-fruited thorn,	435
Cork oak,	120	Double balsam fir,	88
CORNACEÆ,	408	spruce,	81
Cornel,	408	Douglass's spruce,	88
alternate-leaved,	409	Dutch myrtle,	222
dwarf,	415	Dwarf Cassandra,	373
panicled,	411	cornel,	415
red-stemmed,	410	rose bay,	384
round-leaved,	410	sumach,	503
silky,	411		
CORNUS Family,	408	Early fox grape,	468
alternifolia,	409	wild rose,	429
Canadensis,	415	white grape,	468
circinata,	410	ELDER Family,	360
florida,	413	Elder,	361
paniculata,	411	common,	362
sericea,	411	panicled,	361
stolonifera,	410	ELM Family,	284
Córylus,	170	Elm,	285
Americana,	171	American,	286
rostrata,	173	English,	299
Cow berry,	404	Scotch,	305

Elm, slippery,	297	Gaulthéria,	379
twisted,	303	procumbens,	380
white,	286	Gigantic pine,	76
Elsinburg grape,	468	Glaucous kalmia,	394
EMPETRA'CEÆ,	327	<i>Gleditschia triacanthus</i> ,	464
Epigæ'a repens,	378	Glossy willow,	267
ERICA'CEÆ,	370	Golden osier,	269
Euónymus,	476	-twigged lime tree,	511
European cranberry,	406	Gooseberry, common,	419
larch,	91	common wild,	420
larch, planting with,	91	prickly,	420
lime tree,	511	round-leaved,	421
mountain ash,	440	swamp,	421
silver fir,	88	Grape, Bland's,	468
Fagus,	158	Catawba,	468
sylvática, var. Americana,	158	chicken,	470
sylvéstris,	158	common,	467
Felling trees, best modes of,	24	early fox,	468
for timber,	33	early white,	468
Buffon's mode of,	34	Elsinburg,	468
seasons for,	27	fox,	467
Fence of white cedar,	100	frost,	469
Fencing, materials for,	20	Isabella,	468
Fern, sweet,	225	late fox,	468
Fever bark,	347	river,	470
bush,	324	Schuylkill,	468
root,	354	summer,	469
<i>Ficus religiosa</i> ,	279	summer white,	468
Field maple,	481	sweet-scented,	470
Fir,	85	wine,	470
balsam,	85	winter,	469
double,	88	Grape vine,	466
Flowering of the poplar,	248	Grayish willows,	262
dogwood,	413	Great maple,	481
raspberry,	428	Green briar,	533
Fly honeysuckle,	358	GROSSULA'CEÆ,	419
hairy,	359	Ground hemlock,	111
Forests,	1	laurel,	378
form a soil,	30	Grouping of the oaks,	151
materials from the,	11	Guelder rose,	363
pruning,	23	Guelder-leaved maple,	481
sea breezes on,	31	Gymnocladus Canadensis,	465
succession of,	29	Hackberry,	309
thinning of,	23	Hacmatack,	89
uses of,	3	Hairy fly honeysuckle,	359
waste of,	13	honeysuckle,	356
Fox grape,	467	HAMAMELA'CEÆ,	416
Fragrant sumach,	507	Hamamelis Virginiana,	416
Fraser's pine,	88	Hard-hack,	426, 427
FRAX'INEÆ,	332	Hard maple,	489
Fráxinus,	332	Hazel,	170
acuminata,	333	American,	171
pubescens,	337	beaked,	173
sambucifolia,	338	Heart-leaved willow,	275
Frost grape,	469	HEATH Family,	370
willow,	261	Heavy pine,	76
Fuel from the forests,	14	Hedge of red cedar,	105
Furniture, woods for,	20	Helianthemum Canadense,	517
Gale, sweet,	222	ramuliflorum,	517
GALE'GEÆ,	458	Hemlock,	77
		ground,	111

Herbaceous Smilax,	534	June berry,	443
Hickories, insects on,	180	Juniper,	102, 108
Hickory,	187	Juniperus,	102
bitternut,	199	communis,	108
mockernut,	194	Virginiana,	102
pignut,	197		
shell bark,	191	Kálmia,	390
High cranberry,	368	angustifolia,	394
bush whortleberry,	401	glauca,	394
raspberry,	429	latifolia,	392
HIPPOCASTANA'CEÆ,	479	Kentucky coffee tree,	465
Hobble bush,	369		
HOLLY Family,	340	Labrador tea,	
Holly,	341	Landscape maple,	486
mountain,	343	Larch,	89
wild,	343	European,	94
HONEYSUCKLE Family,	352	planting with,	91
Honeysuckle,	356	Large-flowering currant,	422
bush,	359	-leaved maple,	481
fly,	358	pinweed,	518
hairy,	356	poplar,	243
small-flowered yellow,	357	Larix Americana,	89
upright,	389	Late fox grape,	468
Hop hornbeam,	177	LAURINEÆ,	317
HORNBEAM Family,	174	Laurus nobilis,	318
Hornbeam,	313	Leather wood,	325
Horn pine,	313	Leaves, colors of,	8
Horse chestnut,	479	Lechæa,	517
Hudsonia,	518	major,	518
downy,	519	minor,	518
ericoides,	519	thymifolia,	518
heath-like,	519	Lêdum,	395
tomentosa,	519	latifolium,	396
		LEGUMINO'SÆ,	456
Ilex opaca,	341	Ligustrum vulgare,	330
Implements, materials for,	20	LILAC Tribe,	332
Improvable lands,	21	Lilac,	332
Improvement of forests,	16	Lime tree,	510
Indian fig,	279, 424	golden-twiggèd,	511
Indian poke, a remedy for poison,	505	LINDEN Family,	510
Ink berry,	346	tree,	510
Insects injurious to cherry trees,	447	Linnæa borealis,	353
elms,	286	Liquidamber styraciflua,	312
hickories,	180	Liquidamber,	225
locust tree,	459	Liriodendron tulipifera,	529
maples,	482	Little chinquapin oak,	140
oaks,	117	Locust tree,	458
pines,	56	Long-leaved cucumber tree,	527
poplars,	242	Lonicera cærulea,	359
sassafras,	321	ciliata,	358
willows,	254	hirsuta,	356
Ipecac,	348	parviflora,	357
Isabella grape,	468	Lo'teæ,	458
Italian maple,	481	Low blueberry,	403
Ivy, poison,	506	raspberry,	429
		Lyonia paniculata,	375
Jersey tea,	475		
Judas tree, Canada,	465	Maclura aurantiaca,	282
JUGLANDA'CEÆ,	180	tinctoria,	283
Juglans,	181	MADDER Family,	317
cinerea,	182	MAGNO'LIA Family,	525
nigra,	185	Magnolia,	526

- Magnolia acuminata*, . . . 527
auriculata, . . . 527
 heart-leaved, . . . 527
 purple, . . . 527
 small, . . . 527
 three-petalled, . . . 527
 yulan, . . . 527
 MAPLE Family, . . . 480
 Maple, . . . 481
 bird's eye, . . . 491
 blistered, . . . 486
 curled hard, . . . 491
 field, . . . 481
 great, . . . 481
 guelder-rose-leaved, . . . 481
 hard, . . . 489
 Italian, . . . 481
 landscape, . . . 486
 large-leaved, . . . 481
 Montpelier, . . . 481
 mountain, . . . 486, 497
 Norway, . . . 481
 red, . . . 483
 rock, . . . 489
 round-leaved, . . . 481
 scarlet, . . . 483
 soft, . . . 483
 smooth-leaved of Nepaul, . . . 481
 striped, . . . 496
 sugar, . . . 489
 swamp, . . . 483
 Tartarean, . . . 481
 white, . . . 483, 487
 Maple sugar making, . . . 493
 value of, . . . 14
 Maple-leaved arrow wood, . . . 367
 Marking-nut tree, . . . 499
 Massachusetts forests to be im-
 proved, . . . 36
 May flower, . . . 378
Melanorrhæa usitatissima, . . . 499
 MENISPERMA'CEÆ, . . . 524
Menispermum Canadense, . . . 525
 MEZE'REUM Family, . . . 325
 Missouri currant, . . . 419
Mitchella repens, . . . 351
 Mockernut hickory, . . . 194
 Monocotyledonous plants, . . . 532
 Montpelier maple, . . . 481
 MOONSEED Family, . . . 524
 Moose wood, . . . 496
 Morus, . . . 280
 alba, . . . 281
 multicânlis, . . . 281
 nigra, . . . 281
 rubra, . . . 280
 Mountain currant, . . . 422
 holly, . . . 343
 laurel, . . . 392
 maple, . . . 486
 partridge berry, . . . 406
 sumach, . . . 503
 Muhlenberg's willow, . . . 256, 257
 Mulberry, . . . 280
 Mulberry, paper, . . . 282
 MYRICA'CEÆ, . . . 222
Myrica cerifera, . . . 224
 gale, . . . 222
 Myrtle, . . . 222
 Dutch, . . . 222
 Naked viburnum, . . . 364
 Narrow-leaved kalmia, . . . 394
 Necklace poplar, . . . 249
Nemopanthus Canadensis, . . . 343
 Nettle tree, . . . 306
 New Jersey tea, . . . 475
 Nine bark, . . . 426
 Northern red cherry, . . . 451
 Norway pine, . . . 74
 spruce, . . . 88
Nyssa multiflora, . . . 313
 Oakèsia, . . . 327
 Cónradi, . . . 327
 OAK Family, . . . 113
 Oak, . . . 115
 bear, . . . 150
 black, . . . 141
 chestnut, . . . 137
 chincapin, . . . 140
 cork, . . . 120
 little chincapin, . . . 140
 over-cup white, . . . 132
 post, . . . 133
 red, . . . 148
 rock-chestnut, . . . 138
 rough, . . . 133
 scarlet, . . . 144
 sessile-fruited, . . . 157
 species of, . . . 124
 stalk-fruited, . . . 157
 swamp white, . . . 135
 velani, . . . 120
 white, . . . 127
 yellow-barked, . . . 141
 Oaks, grouping of, . . . 151
 planting with, . . . 152
 Occidental plane, . . . 227
 Ochre-flowered willows, . . . 274
 Ohio buckeye, . . . 48
 Oil nut tree, . . . 182
 OLEA'CEÆ, . . . 329
 OLEI'NEÆ, . . . 330
 OLIVE Family, . . . 329
 Tribe, . . . 330
Opúntia coccinifera, . . . 423
 vulgaris, . . . 424
 Oriental plane, . . . 227, 235
 Orme tortillard, . . . 303
 Osage orange, . . . 282
 Osier, golden, . . . 269
Ostrya Virginica, . . . 177
 Overcup white oak, . . . 132

Oxycoccus macrocârpus,	405	Plátanus racemôsus,	237
palustris,	406	Plum, beach,	449
Panicled cornel,	380	bullace,	450
elder,	361	Canada,	449
Lyonia,	375	yellow,	449
Paper mulberry,	282	Plum tree,	448
PAPILIONA'CEÆ,	458	Plymouth crowberry,	327
Partridge berry,	351, 380	Podisôma macrocârpus,	107
mountain,	406	Poison ivy,	506
Pear,	436	sumach,	504
prickly,	424	wood,	504
Pear tree,	437	POMA'CEÆ,	430
Pear-leaved thorn,	435	Poplar,	240
Pepperidge,	313	balm of Gilead,	245
Pérsea gralissima,	318	flowering of the,	248
Peruvian bark,	347	insects on,	242
Picea balsamifera,	85	large,	242
Fraseri,	88	necklace,	249
Pignut hickory,	197	river,	246
PINE Family,	47	Pópulus,	240
Pine and Fir Tribe,	60	cândicans,	245
Pine,	60	grandidentata,	242
cluster,	76	lævigata,	246
Fraser's,	88	monilifera,	249
gigantic,	76	trémulifórmis,	243
heavy,	76	PRICKLY ASH Family,	508
Norway,	74	Prickly ash,	509
pitch,	66	gooseberry,	420
red,	74	pear,	424
Sabine's,	76	Prim,	330
Scotch,	76	Prinos glâber,	346
white,	60	lævigatus,	345
Pinus,	60	verticillatus,	344
Lambertiâna,	76	Prinos-like willow,	259
pinâster,	76	Privet,	330
pinca,	53	Products of the pines,	48
ponderosa,	76	Pruning,	23
resinosa,	74	Prunus,	448
rígida,	66	Americâna,	449
Sabiniâna,	76	doméstica,	448
strôbus,	60	instilûta,	448, 450
sylvêstris,	76	marítima,	449
Pinweed,	517	spinosa,	418
Pistácia lentiscus,	499	Purple beech,	163
terebînthus,	499	magnolia,	527
Pitch pine,	66	Pursh's willow,	272
PLANE TREE Family,	226	Pyrus,	436
Plane tree,	227	Americâna,	439
Planer tree,	312	arbutifolia,	441
Planera Richârdi,	312	communis,	437
ulmifolia,	312	malus,	438
Planting near the sea,	32	sorbus,	441
with birch,	214	Queen of the meadows,	427
with pines,	57	Quercus,	115
with pitch pine,	70	alba,	127
with larch,	91	bicolor,	135
with oaks,	152	castanea,	137
Plants with naked seeds,	47	chinquapin,	140
PLATANA'CEÆ,	226	coccinea,	144
Plátanus occidentâlis,	227	ilicifolia,	150
orientâlis,	235	macrocarpa,	132

Quercus montana,	138	Ribes flóridum,	422
obtusiloba,	133	grossulària,	419
pedunculata,	157	hirtellum,	420
prinus,	137	lacustre,	421
rùbra,	148	nigrum,	419
sessiliflora,	157	prostratum,	422
stellata,	133	rotundifolium,	421
sùber,	120	rùbrum,	419
tinctoria,	141	speciosum,	419
Quince tree,	446	uva crispa,	419
Raspberry, bristly,	429	River bush,	349
flowering,	428	grape,	470
high,	429	poplar,	246
low,	429	Roan tree,	440
red,	429	Robínia,	458
Red birch,	208	hispida,	459
bud,	465	pseudacacia,	460
ash,	337	viscosa,	459
cedar,	102	Rock chestnut oak,	138
currant,	419	maple,	489
maple,	483	Rock Rose Family,	515
mulberry,	280	Rosa'CEÆ,	425
oak,	148	Rosa Carolina,	429
pine,	74	lúcida,	429
raspberry,	429	nítida,	430
Red-stemmed cornel,	410	rubiginosa,	430
RHAMNA'CEÆ,	472	Ro'sEÆ,	429
Rhamnus alnifolius,	474	Rose bay,	383
catharticus,	473	dwarf,	384
Rhododéndron,	383	Rose Family,	425
arborescens,	383	Rose Tribe,	429
campanulatum,	384	Rough oak,	133
chrysanthum,	384	Round-leaved cornel,	410
ferrugineum,	383	gooseberry,	421
'Indicum,	384	green briar,	533
máximum,	384	maple,	481
nudiflorum,	389	smilax,	533
Pónticum,	383	Rowan tree,	440
punctatum,	384	RUBIA'CEÆ,	347
purpureum,	384	Rubus,	428
rhodora,	390	Canadensis,	429
viscosum,	387	frondosus,	429
Rhodora,	389	hispidus,	429
Canadensis,	390	occidentális,	429
RHODO'RA Tribe,	382	odoratus,	428
RHODO'REÆ,	382	sempervirens,	429
Rhus,	500	setosus,	429
aromatica,	507	strigosus,	429
copallina,	503	villosus,	429
coriaria,	500	Sabine's pine,	76
cótinus,	500	Sage willow,	255
glabra,	502	SALICES ALBÆ,	268
radicans,	506	CINE'REÆ,	255
toxicodéndron,	506	CORDA'TÆ,	275
typhina,	501	DISCOLO'RES,	258
venenata,	504	FR'AGILES,	263
verniciifera,	500	F'ULVÆ,	274
Ribes,	419	GR'ISEÆ,	262
aureum,	419	VIMINA'LES,	263
cynobati,	420	Sallows,	255
		SALICI'NEÆ,	239

<i>Salix</i> ,	252	<i>Smilax rotundifolia</i> ,	533
<i>alba</i> ,	268	Smoke tree,	500
<i>angustata</i> ,	278	Smooth-leaved maple of Nepal,	481
<i>Babylonica</i> ,	270	Smooth sumach,	502
<i>cæprea</i> ,	239	Snag tree,	313
<i>cordata</i> ,	275	Soft maple,	483
<i>crassa</i> ,	260	Soil for pines,	56
<i>decipiens</i> ,	265	Species of oak,	124
<i>discolor</i> ,	258	Speckled alder,	220
<i>eriocéphala</i> ,	259	Spice bush,	324
<i>fragilis</i> ,	264	Spindle tree,	476
<i>grisea</i> ,	262	<i>Spiræa</i> Tribe,	426
<i>helix</i> ,	239	<i>Spiræa opulifolia</i> ,	426
<i>lucida</i> ,	267	<i>paniculata</i> ,	427
<i>Muhlenbergiana</i> ,	256, 257	<i>salicifolia</i> ,	427
<i>nigra</i> ,	271	<i>tomentosa</i> ,	427
<i>pentandra</i> ,	268	Spoonwood,	392
<i>prinoides</i> ,	259	Spruce,	77
<i>Purshiana</i> ,	272	<i>black</i> ,	81
<i>rigida</i> ,	276	<i>double</i> ,	81
<i>rostrata</i> ,	274	<i>Douglass's</i> ,	88
<i>Russelliana</i> ,	239, 266	<i>Norway</i> ,	88
<i>sensitiva</i> ,	261	<i>single</i> ,	84
<i>Torreyana</i> ,	277	<i>white</i> ,	84
<i>tristis</i> ,	255	STAFF TREE Family,	476
<i>vitellina</i> ,	269	Staff tree,	478
<i>Sambucus Canadensis</i> ,	326	Stag's horn sumach,	501
<i>pubens</i> ,	361	Stalk-fruited oak,	157
Sand cherry,	453	<i>Staphylæa trifolia</i> ,	477
SANDAL WOOD Family,	312	Steeple bush,	427
SANTALACEÆ,	312	Stiff-leaved willow,	276
Sassafras,	319	Striped maple,	496
<i>officinale</i> ,	319	Study of trees,	35
Savin,	105	Stumps, shoots from,	27
Scarlet-fruited thorn,	434	Succession of forests,	29
Scarlet maple,	483	Sugar maple,	489
<i>oak</i> ,	144	<i>pear, wild</i> ,	442
Schuyllkill grape,	468	SUMACH Family,	499
Scotch elm,	305	Sumach,	500
<i>pine</i> ,	76	<i>fragrant</i> ,	507
Sea breezes on forests,	31	<i>stag's horn</i> ,	501
Season for felling trees,	27	<i>tanner's</i> ,	500
<i>Semecarpus anacardium</i> ,	499	<i>varnish</i> ,	500
Service tree,	441	<i>Venitian</i> ,	500
Sessile-fruited oak,	157	Summer grape,	469
Shad bush,	443	<i>white grape</i> ,	468
Shade of trees,	10	Sun rose,	516
Shell-bark hickory,	191	<i>Canada</i> ,	517
Shining rose,	430	Swamp gooseberry,	421
Ship-building, trees for,	19	<i>laurel</i> ,	527
Shoots from stumps,	27	<i>maple</i> ,	483
Silky cornel,	411	<i>pink</i> ,	387
Silver fir,	88	<i>pyrus</i> ,	443
Single-berry black alder,	345	<i>rose</i> ,	430
Single spruce,	84	<i>sugar pear</i> ,	444
Slippery elm,	297	<i>white oak</i> ,	135
Sloe thorn,	448	<i>whortleberry</i> ,	401
Small-flowered yellow honeysuckle,	357	Sweet birch,	203
Small pinweed,	518	<i>briar</i> ,	430
SMILACEÆ,	532	<i>buckeye</i> ,	480
SMILAX Family,	532	<i>fern</i> ,	225
<i>Smilax herbacea</i> ,	534	<i>-scented grape</i> ,	470

Sweet gale,	222	Vaccinium virgatum,	402
viburnum,	364	vitis idæ'a,	404
wood,	318	Variety of forest trees,	9, 17
<i>Syringa vulgaris</i> ,	332	Varnish sumach,	500
Tanner's sumach,	500	Varnished willow,	265
Tanning, barks for,	20	Velani oak,	120
Tartarean maple,	481	Venetian sumach,	500
TAXA'CEÆ,	110	Veratrum viride, a remedy for poison,	505
Taxodium,	49	VIBU'RNEÆ,	360
<i>distichum</i> ,	101	Viburnum,	363
Taxus,	110	acerifolium,	367
<i>Canadensis</i> ,	111	dentatum,	366
Tecoma,	407	lantanoïdes,	369
Tender willow,	261	lentago,	364
Theet-see,	499	nudum,	364
Thimbleberry,	429	ópulus,	368
Thinning forests,	23	sweet,	364
Thorn,	430	VINE Family,	466
cockspur,	433	Virginian creeper,	471
dotted-fruited,	435	VITA'CEÆ,	466
pear-leaved,	435	Vitis æstivalis,	469
scarlet-fruited,	434	cordifolia,	470
sloe,	448	labrusca,	467
white,	434	riparia,	470
Three-flowered bush honeysuckle,	359	sinuata,	469
-leaved bladder-nut,	477	WALNUT Family,	180
Thuya occidentalis,	96	Walnut,	181
THYMELA'CEÆ,	325	black,	185
Thyme-leaved pinweed,	518	Waste of the forests,	13
Tilia Americana,	511	Water andrómeda,	372
TILIA'CEÆ,	510	WAX MYRTLE Family,	222
Torrey's willow,	277	Wax myrtle,	224
Triosteum perfoliatum,	355	Wayfaring tree,	369
TRUMPET-FLOWER Family,	407	Weeping beech,	163
Tselkwa,	312	willow,	270
Tulip tree,	529	White ash,	333
Tupelo tree,	313	birch,	213
Twin flower,	353	cedar,	98
Two-colored willow,	258	elm,	286
ULMA'CEÆ,	284	maple,	483
Ulmus,	285	oak,	127
Americana,	286	pine,	60
<i>campêstris</i> ,	299	spruce,	84
fulva,	297	thorn,	434
<i>montana</i> ,	305	WHORTLEBERRY Family,	397
<i>racemosa</i> ,	305	Whortleberry,	398
Upas tree,	279	black,	398
Upright honeysuckle,	369	black swamp,	402
Uses of forests,	3	blue,	402
VACC'INEÆ,	397	bush,	400
Vaccinium corymbosum,	401	high bush,	401
disomórfum,	402	swamp,	401
dumosum,	400	Wild black cherry,	455
frondosum,	399	bullace tree,	450
<i>myrtillus</i> ,	398	holly,	343
Pennsylvanicum,	403	honeysuckle,	387
resinosum,	398	WILLOW Family,	239
staminium,	401	Willow,	252
<i>uliginosum</i> ,	398	beaked,	274
		<i>Bedford</i> ,	266
		black,	271

Willow, bog,	258	Willows, two-colored,	258
brittle gray,	262	viminâles,	263
crack,	264	white,	268
dense-flowered early,	260	Wine grape,	470
frost,	261	Winter berry,	344
glossy,	267	grape,	459
heart-leaved,	275	WITCH HAZEL Family,	416
Muhlenberg's,	256, 257	Withe rod,	364
prinos-like,	259		
Pursh's,	272	XANTHOXYLA'CEÆ,	508
sage,	255	Xanthóxylum Americànum,	509
stiff-leaved,	276		
tender,	261	Yellow-barked oak,	141
Torrey's,	277	birch,	206
varnished,	265	plum,	449
weeping,	270	willow,	269
woolly-headed swamp,	259	wood,	509
yellow,	269	Yew,	111
Willow, insects on,	254	Yews,	110
Willows, brittle,	263	Yulan magnolia,	527
cordate,	275		
grayish,	262	Zelkoua,	312
ochre-flowered,	274	Zenôbia racemôsa,	376
sallows,	255		

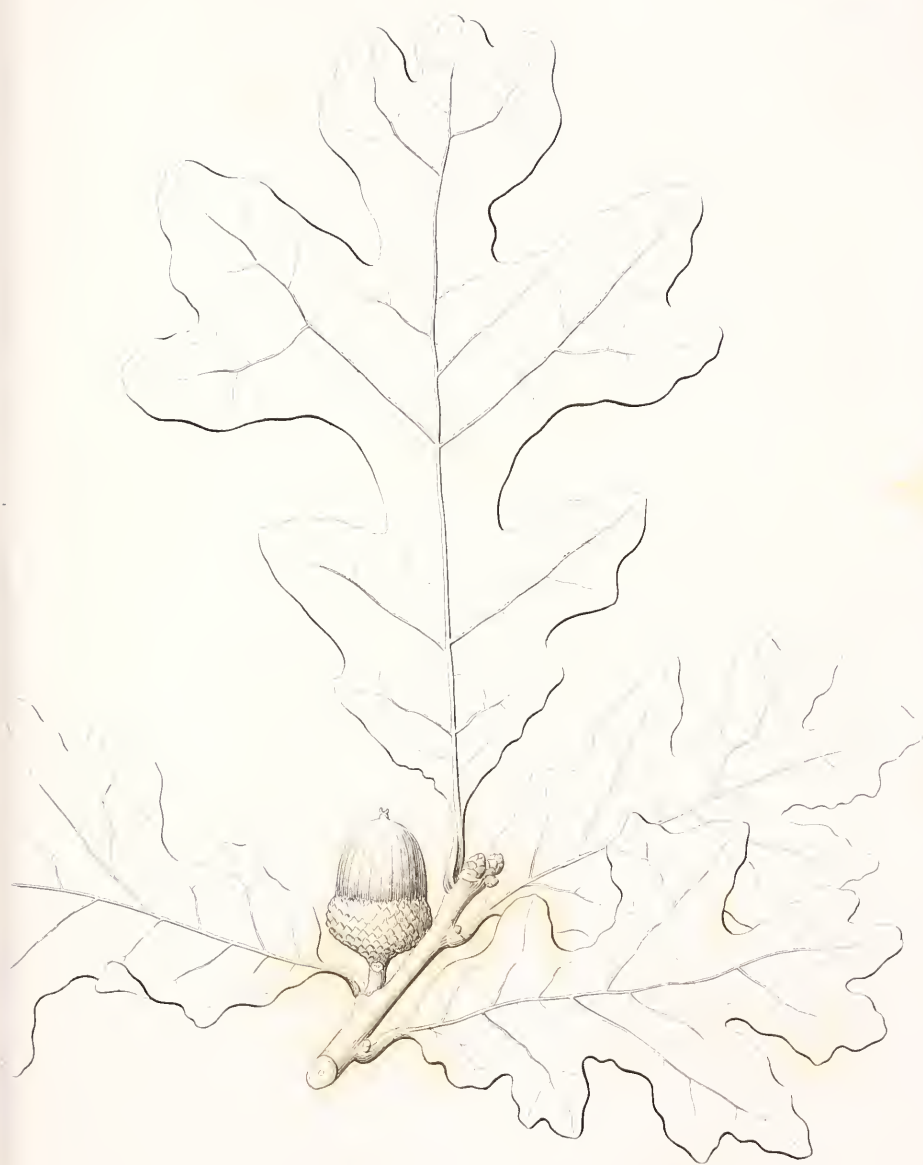




WHITE OAK. *Quercus alba*.



OVERCUP WHITE OAK. *Quercus Macrocarpa.*



ROUGH OAK. *Quercus stellata*.

Drawn by G. S. W. J. N. Y.



SWAMP WHITE OAK. (*Quercus bicolor.*)



CHESTNUT OAK. (*Quercus Castanea.*)

Drawn by G. W. Fisher & H. G. S. G.





BLACK OAK.

Quercus tinctoria.

W. E. S. - N. - k



BLACK OAK. (*Quercus tinctoria*.)



SCARLET OAK. (*Quercus coccinea*.)



RED OAK. (*Quercus rubra*.)



BEAR OAK. (*quercus ilicifolia*.)

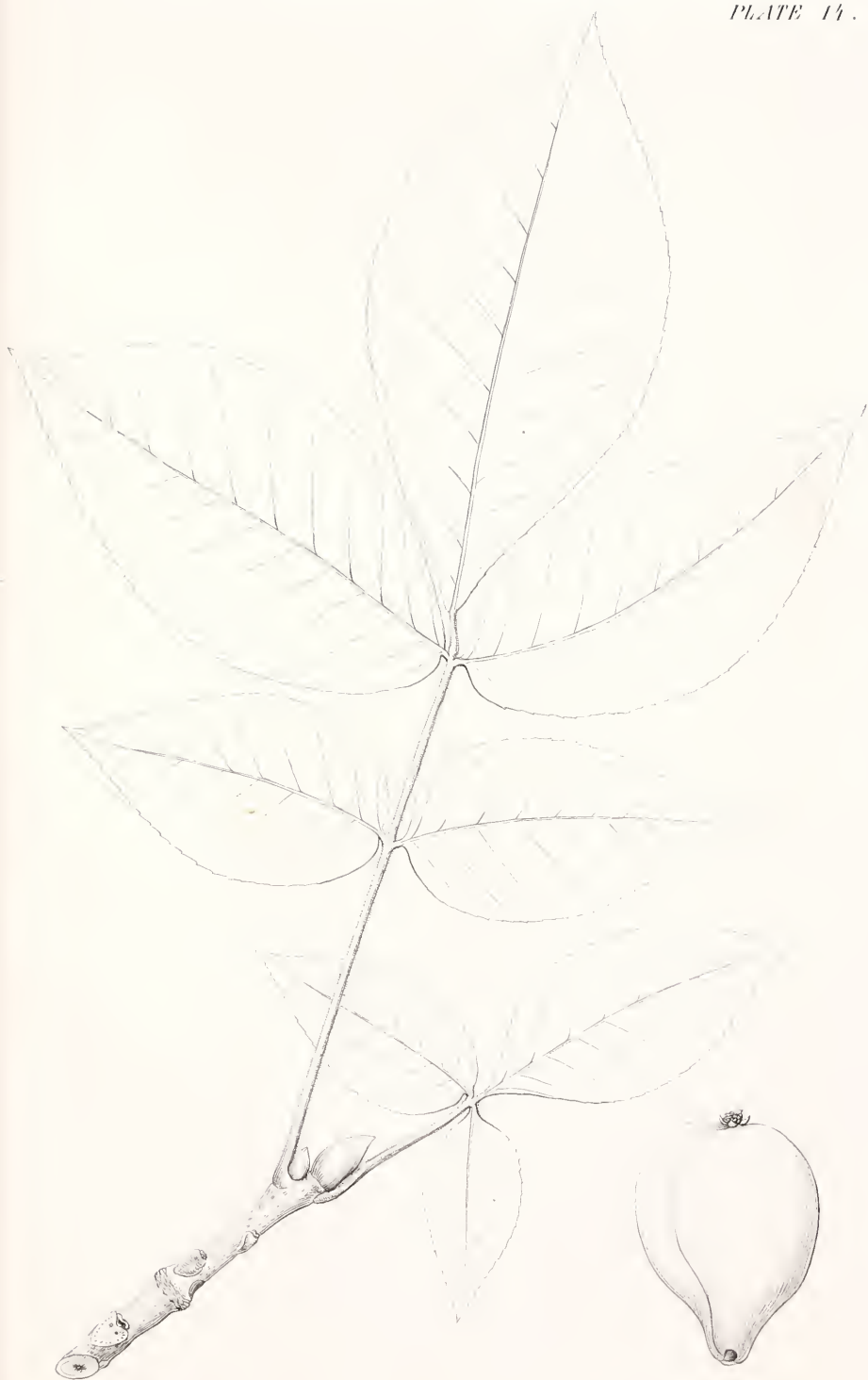


SHELLBARK HICKORY. (*Carya alba*.)

Collected by A. W. Engelm. N. York.



MOCKERNUT HICKORY. (*Carya tomentosa*,)



PIGNET HICKORY. (*Carya porcina*.)



BITTERNUT HICKORY (Carya amara.)



NETTLE TREE, (*Celtis occidentalis*.)



TUPELO TREE (*Nyssa multiflora*.)

